Our New Navy Guns.

The Ordnance Department of the Navy is making all possible effort to complete the batteries for the new cruisers by the time the vessels are ready to be put into commission. The clerical error in the last appropriation bill, which deprived the department of an appropriation for this purpose, will necessarily occasion some delay, but the majority of the guns can be completed in season. They consist of four 8 inch breech loaders, in half turrets, eight 6 inch and two 5 inch breech loaders, for the Chicago; one 6 inch breech loader for the Dolphin, and four 8 inch and six 6 inch each for the Boston and Atlanta. Of the twenty-one 6 inch hooped breech loading guns, five have been completed, six are being made under contract with the South Boston Iron Works, five with the West Point Iron Works, and five are being constructed by our own workmen at the Washington Navy Yard. The steel forgings for all these guns are made by the Midvale Steel Company, of Philadelphia. Of the guns completed one has been tried, and is said to have stood a higher test than any similar gun ever manufactured. The designs for these guns, as well as all the others referred to in this article, were prepared by the Ordnance Bureau at the Navy Department. The weight of the 6 inch gun is 11,000 pounds. It is designed to carry a charge of 50 pounds and projectile of 100 pounds, initial velocity 2,000 f. s. Of the twelve 8 inch guns required, eight have been ordered, and are under construction. Four are being built at the Washington Navy Yard, and two each by the South Boston and West Point Iron Works.

The 8 inch weighs 27,000 pounds; weight of projectile, 250 pounds; weight of charge, 125 pounds; initial velocity, 2,000 f. s. In addition to those above mentioned, the two 5 inch guns for the Chicago and the two 10 inch guns for the Miantonomoh are being made at the Washington Navy Yard. The weight of the 5 inch 30 cal. is 5,800 pounds, charge 30 pounds, and projectile 60 pounds; initial velocity, 2,000 f. s. One of these guns will be of 26 cal., and will weigh 4,200 pounds. The 10 inch gun weighs 53,000 pounds; charge, 250 pounds; projectile, 500 pounds; initial velocity, 2,000 f. s. The tube for the 10½ inch gun will shortly be ordered. The tube for the 12 inch gun will not be contracted for until another appropriation has been made. The 10½ inch gun is designed to weigh 62,000 pounds; and will carry a projectile of 550 pounds, with a powder charge of 275 pounds. The 12 inch gun will weigh 44 tons; charge, 425 pounds; projectile, 850 pounds; initial velocity, 2,000 f. s. A 6 inch wire wound gun is being constructed as an experiment. Its weight is 10,500 pounds; weight of projectile, 100 pounds; charge, 50 pounds; initial velocity, 2,000 f. s.

The Washington Navy Yard is now one of the busiest places in the country, and to ordnance people one of the greatest interest. The shops in this yard employ 270 men, which is probably more than one-half of the whole number employed in the yard. The machine shops of all the other departments have been brought into use for ordnance work, and when all the men are actively engaged, the scene in them is quite animated. The most interesting part of the work is in shrinking the jackets and hoops on the tube. When this work is in progress, Commander Goodrich and his efficient assistants always have a crowd of interesting spectators, many of whom come from distant points to witness the work. This work of assembling the parts is accomplished by heating the jacket to a temperature sufficient to expand it to a size slightly greater than the tube. The utmost skill is necessary in calculating the shrinkage, so as to make the jacket of just sufficient size to pass over the tube when heated and to fit firmly when it cools. Too great a shrinkage would cause a strain on the metal, while too little would prevent the jacket from fitting closely.

The removal of a jacket from its tube, which was recently made necessary with one of the 8 inch guns, is an interesting piece of work, requiring very skillful manipulation. The gun is so fixed that the molten metal can be poured around the jacket, the heat giving it an expansion sufficient to draw the tube out. Great care is taken to raise the tube from the jacket immediately after being loosened. A short delay would cause the tube to expand proportionately, making it impossible to draw the jacket from it.

The steel tubes, jackets, and hoops for the smaller calibers were all furnished by the Midvale Co. The tubes and jackets are rough turned and bored at the yard, and then returned to the Midvale Co., for oil tempering for the purpose of raising the metal up to the standard. After the tubes and jackets have been tempered, and specimens from them tested and approved, they are again sent to the Navy Yard, where they are fine bored and fine turned, preparatory to assembling with the other parts of the gun, many of which are tempered at the yard. This process consists of immersing the steel at a cherry heat in a bath of oil, and there allowing it to cool. For this purpose there is, at the Navy Yard, a tank sunk in the ground about 17 feet deep, with a diameter of 5 feet, and holding 1,000 gallons of oil. It is necessary to have the liquid in which the steel is immersed at a low temperature, and to this end the tank is constructed with a 5 inch space around the inner tank, through which water circulates. Sperm oil was at first used, but cotton seed oil is now substituted, as it is much cheaper and answers the purpose equally well. On cooling, the steel is tested to ascertain the tensile strength, elasticity, and extension, and it is often necessary to repeat the process or to anneal it. The annealing process consists in burying the metal in a tank filled with sand, under which a fire is built and banked, and the whole allowed to cool. When the steel is taken out, it possesses increased ductility.

In addition to the construction of these guns, much work has been and is being done at the yard in the way of making machinery tools, etc., necessary to carry on the work of building the guns. Carriages for the guns are also being made. A great lathe is now being constructed for handling the two 10 inch guns. The jackets have been shrunk on these two guns, and when the lathe has been finished they will be pushed to completion as rapidly as possible.—*Army and Navy Journal.*

How Much Lumber Have We Got?

The stock of pine yet standing in Michigan can produce 40,000,000,000 feet of lumber if cut for that purpose. In eight years, therefore, at average production of the State, the pine will have been used up. But such predictions have been made for years past. In 1867 the standing pine of Michigan was estimated to be 52,416,000,000, and it was predicted that it would all be gone in seventeen years. But since then the Saginaw valley alone has produced about 12,000,000,000 feet, and will continue to cut in the neighborhood of 1,000,000,000 feet a year for eight or ten years to come. As pine grows scarcer it will make more lumber than when it was plenty. But in predicting the end of pine lumbering a person must take into account the timber which is yet standing in Wisconsin, Minnesota, Canada, and the South. And it will be many years before it even grows scarce, when we estimate the whole. Yet an end must come to the forests that the white race found in this country. Doubtless pine forests of the second growth will be raised for future use, but the present magnificent forests will disappear. It has been estimated that the demand for lumber in this country from 1880 to 1890 would require 210,000,000,000 feet, and one can readily see that at that rate the stock must soon be gone. There is only about 55,000,000,000 feet of pine in Canada, and that would go but a short way in saving the forests of the United States.—*Chicago Current.*

The Rail Trade in the United States.

The problem which confronts the steel-rail manufactures of this country, that of obtaining a market for their product, is one which will have a great influence upon the iron trade, and through that industry many others dependent upon it for support. The Iron Age in a recent article called attention to the production and consumption of rails in the country in connection with the probable amount needed every year for building new roads and repairing or renewing old ones. The following table shows the increase per year of mileage, total consumption and the amount in tons used for new roads and renewals of old ones:

	Inc. of milage.	Total consumption.	New roads.	Renewals.
1867	2,449	627,157	279,200	347,957
1868	2,979	756,795	339,600	417,195
1869	4,615	906,749	504,000	402,749
1870	6,070	1,019,153	663,000	356,153
1871	7,379	1,341,434	814,800	526,634
1872	5,878	1,530,850	648,900	881,950
1873	4,107	1,148,849	453,400	695,449
1874	2,105	837,724	234,900	602,824
1875	1,712	810,770	191,000	619,770
1876	2,712	879,916	302,680	577,316
1877	2,281	704,744	257,300	507,444
1878	2,687	882,695	303,000	579,695
1879	4,721	1,157,420	532,500	624,920
1880	7,174	1,752,526	817,800	934,726
1881	9,789	2,230,421	1,116,000	1,114,421
1882	11,591	1,912,921	1,321,000	591,921
1883	6,755	1,399,671	770,100	629,571
1884	3,800	1,120,000	434,200	685,800

This table shows what a large amount is used yearly for renewals as compared with that used in building new roads. From the conclusions reached by the Iron Age it is stated that the total amount of rails which will be needed each year is about 600,000 tons. If the railroad building in this country continues at the rate of 4000 miles per year the orders from this source, it is stated, will not reach as high as those dependent upon renewals. The consequence would be that the capacity of the rail mills would be larger than the demand, and, according to the Iron Age, the outlook for the rail manufacturers under those conditions does not seem to be very encouraging. The advisability of obtaining a footing in foreign markets would seem to recommend itself forcibly to the steel-rail manufacturers of the United States.

Drawing Wire From Fluid Steel.

The *Manufacturer's Gazette* says: Wires and bars are now produced direct from fluid steel, by pressing it out through dies in a manner similar to the production of lead pipes from lead. An iron vessel, lined with refractory material, is provided with a manhole and a cover at the top, and securely closed. At the bottom opposite the manhole there is a cast-iron outlet pipe, through which passes a steel tube with water circulating round it exactly like a "tuyere," by which the steel pipe or die can be cooled. The inner end of the steel tube is lined with fire clay, where the very hot fluid steel meets it. The tube is plugged up by a steel stopper, and the liquid steel is filled into the vessel with liquid carbon dioxide above it. The stopper being withdrawn the liquid steel is forced out by pressure of the carbon dioxide in a red hot rod of iron, which goes from the vessel into the rolling mill while still hot, and is there finished off. We may also add that steel is now produced direct from the ore by a new process of a French engineer. The ore in a powdered condition is submitted to the action of carbonic oxide gas at a high temperature in a cupola or blast furnace, where it is reduced by the incandescent gas to pure iron or steel.

The Tensas River Bridge, M. & M. R. R.

Written for ENGINEERING NEWS.]

BY COL. WM. M. PATTON, C. E.

As stated in a previous article (ENG. NEWS, April 4, 1885) the distance from Tensas to Mobile, across the swamps, is about 14 miles; in this length there are two large and five smaller bridges with several miles of pile trestle. All of this work, excepting the Tensas River bridge and a small portion of the trestle work, was under the charge of the author, who has already described the Mobile River bridge in the article referred to above. The Tensas bridge will now be briefly referred to.

Col. G. Jordan, the Chief Engineer of the M. & M. R. B., determined to use for the Tensas bridge the Cushing piers, with two brick abutments resting on piles. There were twelve cast-iron cylinder piers and one cast-iron pivot-pier; the total length of 2,000 feet being thus divided into 12 spans of about 140 feet each, and a draw span of 360 feet measured from end to end.

On June 16, 1870, the contract for this work was let to the Boynton Bros., of Boston, Mass., and work was at once commenced. Each pier, excepting the pivot-pier, was made of two cast-iron cylinders 6 feet in exterior diameter and located 16 feet between centers cast in sections, 10 feet long, of metal 1½ inches thick, and united by interior flanges 2 inches thick and 3 inches wide. The sections were held together by 40 bolts, each 1¼ inch in diameter, and the lower section in each pier was provided with a cutting-edge. The top section was cast especially of the length required to bring the pier to its proper elevation.

The pivot-pier was composed of one central cylinder 6 feet in diameter, and six cylinders of 4 feet diameter arranged hexagonally. The radius of the pivot circle, measuring from the centers of cylinders, was 12½ feet. Each cylinder was capped with a cast-iron plate 2½ inches thick, secured to the cylinder with 20 one-inch bolts, and finished with a capital made according to plans furnished by the engineers.

In each of the large cylinders, 12 piles, and in each of the smaller cylinders, 5 piles, were to be driven to a depth not less than 20 feet below the bed of the river; these piles were to be held together at the top by 8 bolts, each 1½ inches in diameter. The iron cylinders were to be sunk to a depth of not less than 10 feet below the river bed; and the piles were to be cut off at low-water mark, the water pumped out of the cylinder, and the latter to be then filled to the top with concrete made of one part best hydraulic cement, two parts of clean, sharp sand, and 2½ parts of good, hard shells, all by measure. The iron cylinders were to have two coats of a first-class mineral paint applied before sinking, and a third coat on all exposed parts after the pier was completed.

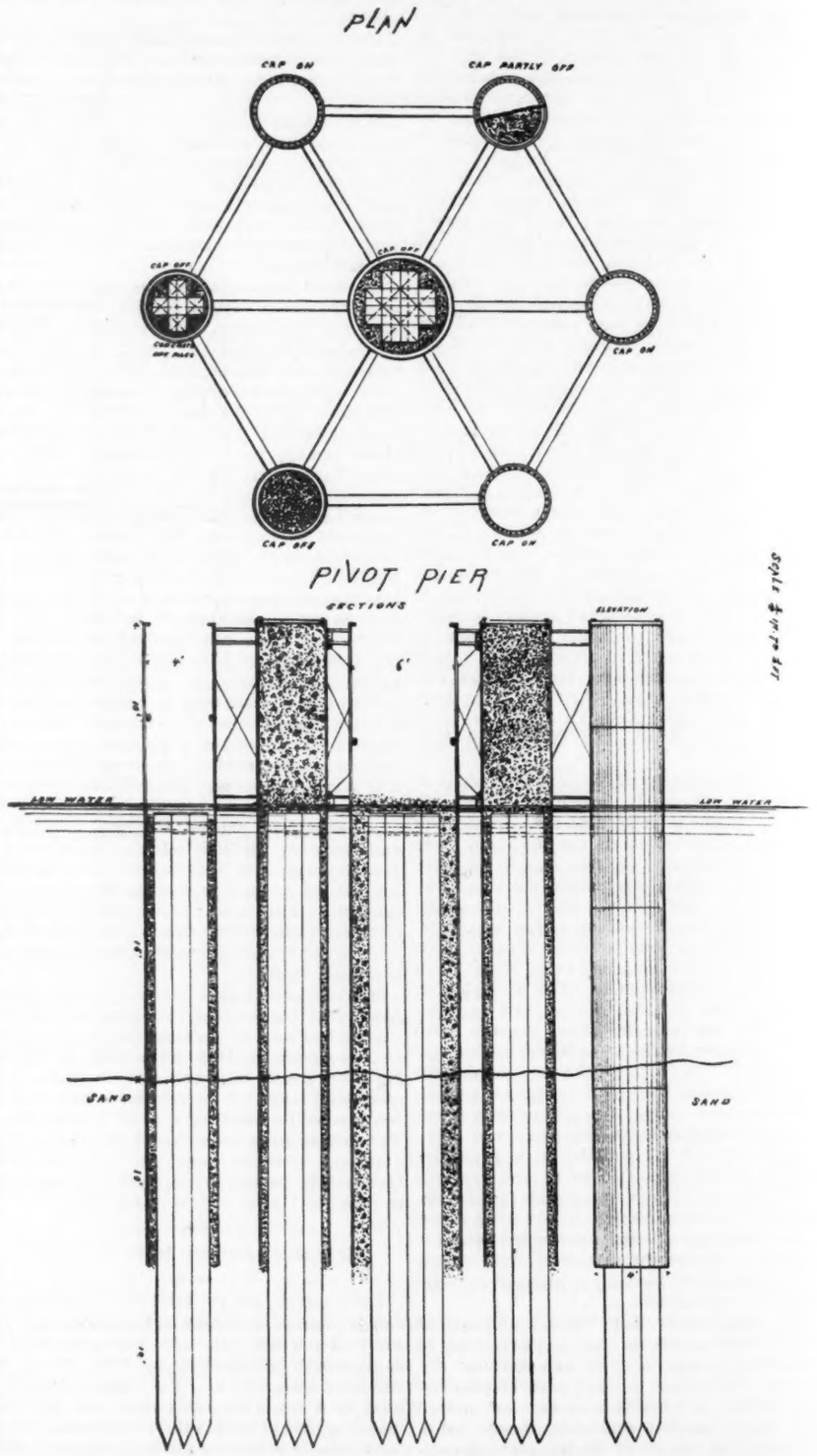
The brick abutments rested on a foundation of 56 piles, driven about 2 feet between centers and sawed off 2 feet below extreme low tide and capped with 12 × 12 inch pine sticks covered with a solid floor 12 inches thick of whole timbers.

In making a foundation with the Cushing system, the piles may either be driven first and the cylinder sunk over them, or the piles can be driven inside the cylinder in place. In the latter case, however, the cylinders may be subjected to undue strains and to subsequent damage from shock and vibration; the sawing off of the piles would also be very difficult and inconvenient, or they would have to be left at irregular heights and with battered tops; the disturbance of the material might cause the cylinder to careen, and to correct this would be an exceedingly difficult if not impossible task. On the other hand if the piles are driven first, there is danger of the piles spreading and thereby interfering with the sinking of the cylinder.

In the Tensas bridge the piles were driven first; these piles were made from the long-leafed pine, sawed not less than 10 inch square at the small end. As is well known it is a difficult task to drive a close cluster of piles in fine and compact sand; and, as there were 12 piles in each cylinder, these piles had to be in almost perfect contact for their whole length. This was accomplished however by driving the piles with their points in contact as near as possible and then pulling the tops together and holding them in position by bolts. In a foundation of this kind a fine opportunity is presented for applying the water-jet, especially when the cylinder is sunk first, but the danger of tipping the cylinder is in this case somewhat increased.

After the piles were driven a sufficient number of cylinder sections were bolted together to extend from the river bed to above the water surface; and this compound cylinder was then lifted and placed over the piles and sunk to the required depth by the water-jet. Little or no weight other than that of the cylinders themselves was necessary. Owing to the depth sunk and the proportionally large space occupied by the piles, a special arrangement of water pipes was required; a 3-inch canvass hose conveyed the water from the pump into a small vessel suspended over the center of

TENSAS RIVER BRIDGE, ELEVATION AND PLAN OF PIVOT PIER.



the cylinder; this vessel had a number of small pipes, with elbows at their ends, radiating horizontally from it, the length of these being a little shorter than the radius of the cylinder. To the ends of these pipes were attached other pipes directed vertically downwards, their length being increased as the cylinder sank. When the pump was started the water issued with great velocity, stirring up and loosening the material at the bottom of the cylinder, which sank rapidly.

The space around and over the piles to the top of the cylinder was filled with concrete, the cap-plate was bolted on and the pier was complete.

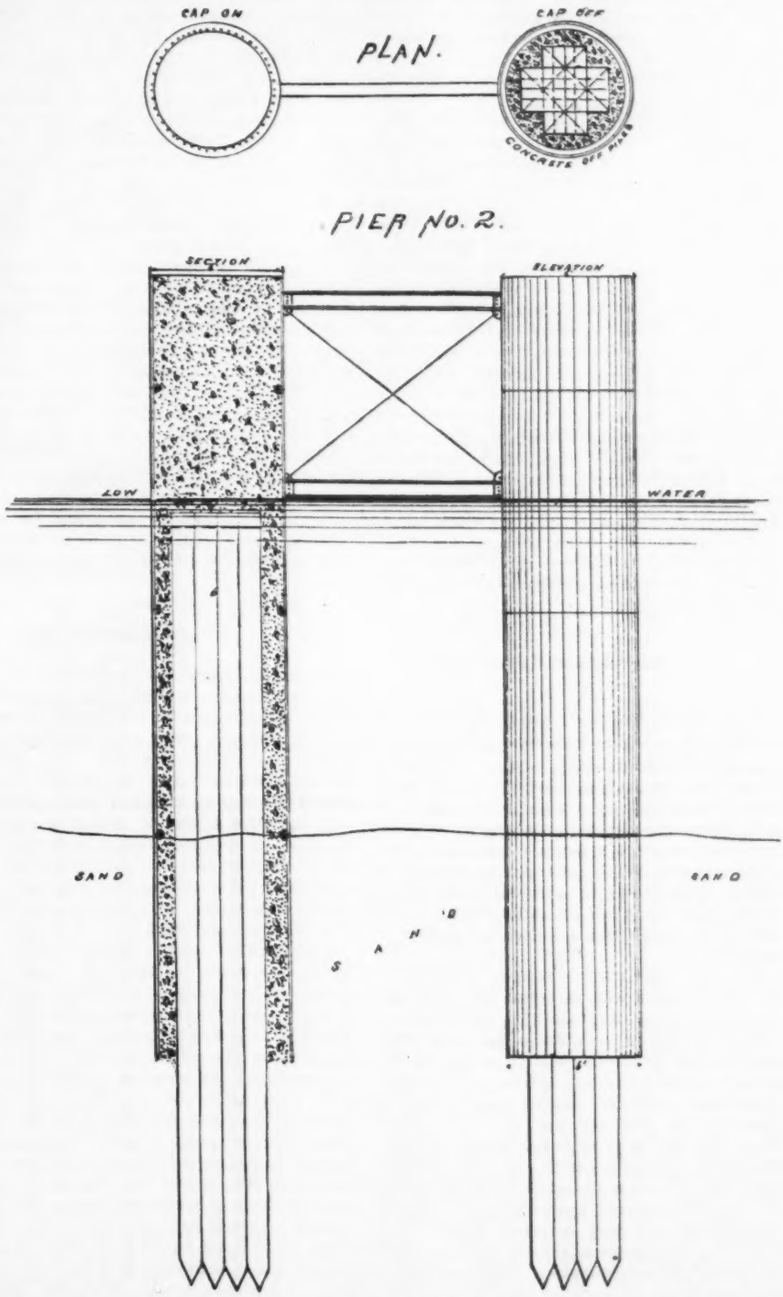
The superstructure of this Tensas bridge was a combined wood and iron Warren girder; all tension members being of iron, and all compression members of wood. The draw-span was iron throughout. The contract for this portion of the work was awarded to the Louisville Bridge Company.

At first sight the supporting power of these piers would seem to be small; as the iron cylinder is designed simply as a shell to surround the relatively small column of concrete which directly supports the load, and is in turn carried by the cluster of piles and the material surrounding them. The direct bearing is 56½ square feet to each pier, but in addition to this we have however 640 square feet of pile surface to be multiplied by the frictional resistance per square foot; the frictional resistance of the iron shell also affords some additional support which, however, was not considered in the calculations for resistance to load. On the screw-pile piers of the Mobile River Bridge, there were in each pier about 100 square feet of direct support, the frictional resistance of the small iron shafts being neglected. The foundations of both of these bridges have stood the test of 14 years use, and according to report have proved satisfactory in every respect.

As a matter of interest to engineers and contractors, the prices paid for the various kinds of work are annexed; with the caution that this work was done in 1870 and in the swamps of southern Alabama.

Brick Masonry	$33.00	per Cu. yd
Timber Flooring for Abutments	27.50	" M B M.
Piles and Driving	0.33	" Lin. ft.
Cushing Cylinders, Cast-iron	0.04¼	" Lb.
Bracing and Bolts, wrought-iron	0.13	" Lb.
Sinking Cylinders and bracing (measuring from top to bottom of cylinder)	7.50	" Lin. ft.
Concrete	11.50	" Cu. Yd.
Timber Trestle, measured horizontally; if the piles were driven over 30 ft., 33 cts. extra was allowed for each additional foot	7.50	" Lin. ft.
Track Laying	550.00	" Mile.
Clearing	40.00	" Acre.
Earthwork, measured in borrow-pit	0.33⅓	" Cu. Yd

TENSAS RIVER BRIDGE, ELEVATION AND PLAN OF PIER No. 2.



A Novel Protection to Ships.

The long-standing rivalry between heavy ordnance and armor plates is likely to be disposed of in a manner little expected, as a means appears to have been discovered where by the effects of shot and shell, and even torpedoes, will be effectually neutralized. For some time past naval architects have ceased to rely solely upon armor for the protection of ships, for, notwithstanding the enormous thickness to which armor plates had attained, they were found to be no match for the artillery that was brought to bear upon them. Steel plates and compound plates were next tried, but to no avail. As a further increase in the thickness of plates, whether of iron or steel or both combined, was impracticable; owing to the overweighting of vessels with armor, shipbuilders tried the expedient of supplying a second line of defence in the coal bunkers, which were constructed along the sides of ships, especially those parts where the machinery and magazines are located. They certainly, to some extent, furnished that second line without overburdening the vessel, for coals have to be carried under any circumstances. But a far more effective protection appears now to have been supplied by the invention of a composition which, besides being efficacious as a protector, possesses the merit of being light—a desideratum much wanted by naval constructors. This composition is a preparation obtained from cocoanut cellulose, which has the remarkable property, when penetrated by shot and shell, or even after the explosion of a torpedo, of closing up as rapidly as it has been in preventing the influx of water into the ship's hold. The very appropriate, name of "coffer-dam" has been given to the preparation, which, besides being very light, is highly elastic and tenacious. Some important experiments have lately been made with the composition before a French commission at Toulon, which, if everything that is reported concerning them is true, prove the preparation to be destined to solve the armor plate controversy. The commission submitted the composition to a three-fold test against shot, shell and torpedo. The target was a coffer-dam made of a mixture of 14 parts of pulverized cellulose and 1 part of cellulose in fiber. This composition was compressed to a felt-like mass, of which 1 cubic foot weighed about eight pounds. A layer of beams 4½ inches thick represented the side of the ship, behind which there was a layer of coffer-dam 2 feet thick. Against this target a 7½ inch solid shot was fired, which penetrated it, taking with it not quite ¼ cubic foot of composition, a very small quantity, considering the size of the shot. But as soon as the shot had passed through the target the cellulose composition closed up again, and so firmly that a strong man was unable to force his arm through the opening made. A box filled with water was then fixed against the aperture, the contents of which ought to have acted in the same way as if the coffer-dam had been washed away by the sea. It was observed that a few drops of water began to percolate after the lapse of from 10 to 15 minutes, and even after the composition had become well saturated with water, only between 3 and 5 pints of water escaped per

minute, which could be easily intercepted by pails. As soon as the cellulose had become thoroughly soaked and grown denser, it offered greater resistance to the percolation of water, which finally almost ceased to flow. The experiments with shell gave similar results, the breach made closing automatically. It was also found that the coffer-dam was proof against fire. A special experiment was made in which red-hot coals were placed upon a mass of coffer-dam, and covered with the same composition, the result being that the fire went out. The experiments with torpedoes were not so decisive as those with shot or shell. A chest was anchored out at sea, one side of which was lined with coffer-dam, a torpedo attached to it, and exploded. The chest floated for a few seconds and then sank. When fetched up by a diver, it was found that the lid had been blown off, but that the coffer-dam composition was little injured. The above experiments appear to prove that the material in question possesses the property of automatically closing a leak caused by shot or shell, and of protecting a ship to a certain extent against fire. Whether its use will render ships unsinkable remains to be shown, but we understand that in order to investigate this point thoroughly further experiments on a larger scale are to be undertaken by the Toulon commission.

Ventilation of Sewers.

Dr. Alfred Carpenter writes to the *Journal* of the Society of Arts as follows:

If a sewer flushes clean, as it ought to do; if it does not become the habitat of sewerage confervoid growths upon its invert; that is, if it is regularly scoured above, as well as below the line at which the sewage ordinarily runs; if there is nothing to intercept the passage of sewage from its origin to its departure at the outlet, then there will be no sewer gas, there will be no stink, there will be no danger to anybody.

The openings on the inverts of the arch of the street sewer will be inlets for fresh air, and the ventilators produced by the extension of the soil pipe of every water-closet above the level of the house top will be outlets for the air which has passed through the sewer. Thus a constant circulation will be promoted at all times by the ordinary laws which belong to gases, and which by their very nature prohibit stagnation in fluids of all kinds. Occasionally there may be down draughts, but they will be of no more moment than the down draughts through an ordinary chimney—indeed they will be as infrequent as a down draught into a furnace when the fire is low. Fresh sewage is not dangerous to anybody, but if it is kept within the curtilage of the dwelling-house by means of interceptors, or if it be allowed to stagnate in a badly-constructed sewer until fermentative changes have arisen within its substance, it then produces the chance of evil; but in the present day no authority ought to be allowed to keep sewage within its borders until such a change has taken place. It should be "moved on" out of range as rapidly as possible. The house is the unit of sanitary work, and it is wrong for selfishness to assert itself so as to determine that no man shall assist the local authority in its duty to provide for sewer ventilation.

I utterly object to the principle which is being tried to be established by various supposed authorities, viz., that the duties of the individual are antagonistic to the duties of the local authority in the matter of sewers. If each unit does his part, the duty of the local authority as to ventilation is simple. The latter has to convey away the sewage, and provide inlets for fresh air. The outlets must be at the highest points, and if they are so placed, there will not be a particle of danger from the production of sewer gas. An authority has an important duty to perform, viz., to prevent the production of sewer air, as a major part of its work. The provision for its escape, if it does accidentally form, will be best met by details in the construction of the house drain. Concentration should not take place, and without concentration sewer gas is perfectly harmless. There will be no diffusion of enthetic germs, for they cannot live in fresh air long enough to spread infective disease, and if, perchance, a few should be discharged in the higher regions above the heads of a great or small community, they die in a very few seconds.

The germs which reproduce enthetic disease cannot live in fresh air, any more than a fish can live in unaerated water. If discharged, they should be diffused above the heads of the people, and not at the street level. These are my reasons for advocating the extension of every soil pipe, so that each water closet has a ventilator in action, and by this means properly constructed sewers will admit fresh air at the street level; and under common conditions, foul air, if produced, will escape, where it will fail to set up even the smallest possible danger. I advocated this principle twenty years ago, and experience, since my first paper upon this subject, has amply proved that I am right.

Fireproof Doors.

The most efficient fireproof doors are wood covered with tinned iron. The door is made of two thicknesses of tongued and grooved boards, crossing each other diagonally and thoroughly nailed together. The sheets of tin are bent over at the edges, forming locked joints as in a tinned roof; it is important that the edges, as well as the sides of the door, be covered, as its resistance to heat lies in the fact that the fire cannot burn the wood thus protected against exposure to the air, nor can it warp it, as in the case with an iron fire-door subjected to slight heat.

If a fire-proof door is hung on hinges, especial care must be taken to insure their security by fastening them to the door by means of bolts, rather than screws, and connecting them to the wall in an equally secure manner. The latches should be selected with a view to durability, as such a heavy door is apt to be destructive of weak latches. Where the position of the doorway permits sliding doors, it is preferable to have them on tracks, care being taken that cleats be placed on the floor each side of the doorway, so as to secure the door at its lower corners when shut.

In the Boston Storage Warehouse, U. S., there are a large number of such doors in the fire walls, arranged to close an electric circuit when they are all shut, and the fact is recorded on the paper dial of the watchmen's clock at certain intervals. Fireproof doors are frequently arranged to close in advance of a fire by means of the yielding of the alloy fusible at 160° Fahr. The track upon which such a door is hung inclines about 1 foot in 8 feet, and the door kept from closing by means of a round stick about 1 inch in diameter, which reaches from one edge of the door to the opposite side of the door frame. At the middle, the stick is cut in two diagonally, and a ferrule made of two pieces of thin copper soldered together longitudinally with the fusible alloy, covers the joint in the stick. When this ferrule is exposed to a temperature of 160° Fahr., its yielding causes the ferrule to split open, and the stick separates into pieces and allows the door to shut. In order that the stick shall not fall in the way of the door, and that the door may be shut at any time, the stick is connected to the top of the door frame by small chains near to each end.

This simple device was designed by Mr. Lewis T. Downes, President of the What Cheer Mutual Insurance Company. Another method of utilizing this fuzible alloy to close fireproof doors and shutters, is by means of a wire extending around the room, and containing in various places links made of two pieces of brass soldered together. When the solder melts and allows the two pieces of brass to separate, the wire allows the shutter or door to close. Mr. Frederick Grinnell has improved the ordinary link by cutting a slot in one of the pieces of brass, and laying a short bit of wire therein, when they are being soldered together; the solder flowing around this wire presents a resistance in three planes in place of the ordinary joint which may be imperfect and lies in a single plane, concealed by the sheet brass so as to prevent inspection. Formerly solid links of fuzible alloy were used, but the metal has so little resilience that it is apt to gradually lengthen and finally break at some inopportune time.—*Engineering.*

Preventing Collisions with Ice-bergs in a Fog.

Science, for June 5, contains an article by Prof. Alex Graham Ball, describing the method suggested by Mr. F. Della Torre, of Baltimore, Md., for the detection of ice-bergs in a fog by obtaining an echo when the berg is dangerously near to the ship. The following description of recent experiments is given:

These experiments were made on the River Patapsco near the head of Chesapeake Bay, at a point about seven miles from the city of Baltimore. The party proceeded down the river in a steam-launch to the selected place, where the distance from shore to shore appeared to be about three miles.

The launch was kept so far from land as to prevent the possibility of mistaking an echo from the shore for one produced by a passing vessel.

The apparatus employed consisted of a musket to the muzzle of which a speaking-trumpet had been attached. This gun was aimed at passing vessels, while blank cartridges were fired. After a longer or shorter time, according to the distance of the vessel, an echo was returned.

The ordinary river steam-boats, and schooners with large sails, returned perfectly distinct echos, even when apparently about a mile distant. At shorter distances the effects were, of course, still more striking.

In order to test the effects under the most disadvantageous circumstances, blank cartridges were fired in the direction of an approaching tug-boat. The surface presented was, of course, much smaller than if the boat had presented its broadside to the launch. As the boat approached bow on, it corresponded to a target somewhere about six feet square, presenting a convex surface to the impinging sound-wave. Even in this case a feeble echo was perceived when the boat was at a considerable distance (estimated to be nearly one-quarter of a mile). That any echo should have been perceived at all under such circumstances, was a surprise. The sound was heard only by the closest attention, but in the case of larger vessels the effects were very distinct and striking.

Experiments were made which demonstrated the fact that the speaking-trumpet attached to the gun was of material assistance in giving direction to the sound-impulse, and in intensifying the audible effect.

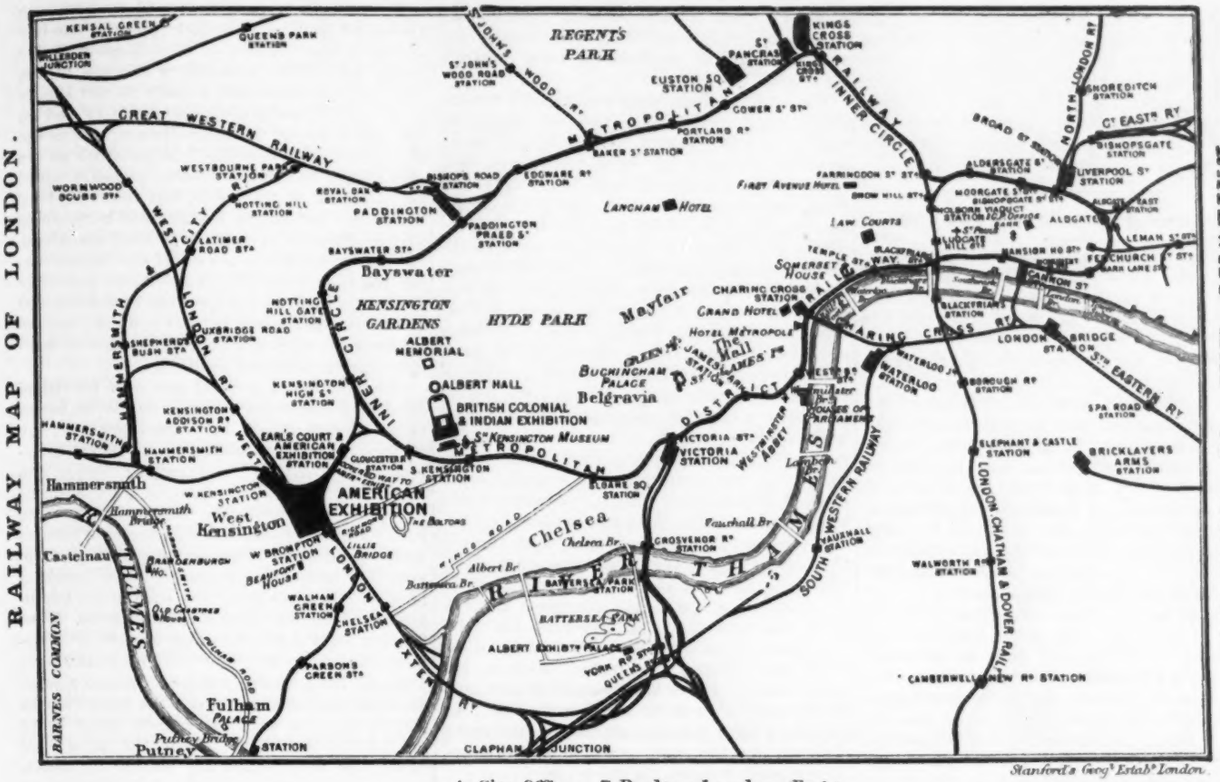
Mr. Della Torre claims that a steam-whistle or siren, combined with a projecting apparatus like a speaking-trumpet, will prove as efficient as the gun.

During the experiments on the Patapsco River, a curious rumbling effect, like the rolling of thunder, was often observed, which continued for some seconds. A similar sound was also noticed, as an echo from a well-wooded shore; but the effect alluded to above could not have been due in any way to the land, as the sound commenced immediately upon the firing of the gun, whereas the shore was distant at least a mile or a mile and a half.

The sound was probably due to the presence of ripples on the surface of the water, as the effect was much less marked when the surface was smooth. Such a sound might prove a distinct element of importance in a rough sea, but would hardly be sufficient to prevent the detection of an echo from a large iceberg. Had shots been fired periodically from the bow of the City of Berlin, it can hardly be doubted that the presence of an obstacle ahead would have been discovered in time to prevent the collision that actually occurred.

ENGINEERING NEWS Three months for One Dollar.

THE AMERICAN EXHIBITION. LONDON, 1886



‡ City Offices 7. Poultry London (Eng.)

The American Exhibition, London, 1886.

Now that a site has been definitely secured, it is possible to discuss the American Exhibition of 1886 as a tangible thing instead of a project in the air. It is characteristic of the country and the people to be represented by this Exhibition that it deliberately elects to compete for popular favor with the Colonial and Indian Exhibition, instead of waiting another year, and that it does not fear to face the risks involved in an enormous outlay for rents, buildings, etc., as against the free grounds, free buildings, and interested patronage of the other. Such boldness compels admiration, and would inspire doubt as well, if it were to be any other than an American undertaking.

The accompanying map indicates very clearly the site obtained for next summer's rival to our colonial brethren's show. From the railroad access point of view it is superior to the Kensington grounds, being in close contact with three underground stations, representing as many lines. The space marked with black covers 22 acres, practically the same as the other, and soon the work will be begun on it by grading, tree-planting, and building. The plans for the various structures have long been outlined, and will soon be completed. They are on an appropriate scale of magnitude, and will embody all the advantages which two generations of Exhibition managers can suggest.

The general public will be, however, more interested in the question—What is to be in these buildings? It has not escaped notice and comment that among the most interesting features of the Inventions-Exhibition are the American exhibits—the Waltham Watch Factory, the Troy Laundry, and that sinister family of machine guns, the Maxim, the Gardner, the Hotchkiss, and the Gatling, which lend a murderous tinge to the aphorism that America is the most peaceful nation on the globe. The organizers of the American Exhibition promise whole halls full of exhibits rivalling these in popular interest, and a multitude of non-mechanical features surpassing them.

London will then be given its first opportunity to realize also the essentials, at least of the folk life which "Uncle Tom's Cabin" so graphically portrayed, for it is in contemplation to reproduce here a Southern tobacco factory, with its dusky "hands," who sing as they work (delightful singing it is too), just as the traveller to-day can see them in Lynchburg or Durham. Other peculiar industries—gold-mining, logging, rice and cotton growing, and the like—will also be illustrated. The wilder side of life in the West will be exemplified by a village of Indians, with their rude crafts of beadwork, basket weaving, and canoe building.

There will be an art gallery, specially constructed for the purpose, containing a most interesting and valuable collection from American artists, the most complete and representative in character ever made on either side of the water. A more novel feature, unique in the record of Exhibitions, will be a crack National Guard regiment from New York city, which is to be the guest of the Exhibition for a time, and which Americans here fondly believe will excite at once the awe and admiration of the effete monarchies of Europe.

We have selected at random a few of the more bizarre features from a bewildering array of projects with which General Norton's brain is teeming. Enough has been said to show that the exhibition proper will invite study and repay it. As to the decorative phase of the affair, there seems to be some force in the suggestion that the country which invented the electric light ought to be able to use it as effectively and artistically as we can here, at least. And as for liquid refreshments—probably we are not in it at all.—*Pall Mall Gazette*, May 30th.

Above the Gulf of Mexico.—The floor of the portico of the Boone County, Mo., court house is 747 feet above the mean level of the Gulf of Mexico.

Deep Sea Soundings.

The United States cutter Blake put into Charleston, June 3. The Blake started several months ago for the Northwest Providence channel for the purpose of taking deep sea soundings, but shortly afterwards left there to anchor in the Gulf stream, between the Fowey rocks and the Bahama banks.

The spot where the Blake anchored was just 200 miles east of the deepest part of the Atlantic Ocean—1500 fathoms in depth—discovered by Capt. Pillsbury two years ago. The Blake anchored in 481 fathoms, and succeeded in dredging up a large quantity of specimens of animal and vegetable life. These are under the charge of Dr. Rush, U. S. N., but they have not yet been tabulated, and when this is done, among them will probably be found many species hitherto comparatively, if not entirely, unknown. But until they shall have been tabulated Dr. Rush does not care to have them inspected by the unscientific world.

Captain Pillsbury's current motor—his own invention—worked most satisfactorily, as did all his apparatus. The motor measured the spread and velocity of the currents in 3½, 15, 30, 65 and 180 fathoms of water. Though Captain Pillsbury has not yet completed the calculations bearing upon the velocity of deep sea currents from the data on his charts, he says he is pretty well convinced that in the lower depths the change in the velocity is not so great as towards the surface. The surface currents are stronger with the deflection of the moon, and as this deflection in these latitudes was always greatest at this time of the year towards the full moon, it follows that these surface currents are now at their strongest.

It is plain, from his observations during the past three months, that the strength of current of the Gulf Stream is invariably on the Florida instead of the Bahama side of the stream. He has found the temperature of the stream to range from 42 degrees to 81 degrees. The greatest velocity of the stream at the su

face is about 4½ knots, but the fluctuations are frequent and great.

Altogether Capt. Pillsbury has had a most satisfactory voyage, and when his observations shall have been properly tabulated, and his calculations reduced he says he will be able to give the scientific world a treat as to deep sea sounding, current velocity, animal and vegetable life, and the earth's surface for miles, under the sea.—Savannah *Morning News*.

The Dome of the Observatory at Nice.

On May 15th last, a delegation from numerous scientific societies, including a number of the members of the French Society of Civil Engineers, examined the great dome for the observatory at Nice, which was then about completed in the works of Mr. Eiffel, at Levallois—Perret.

This dome is said to be a masterpiece of metallic construction, and greater in size than any constructed to the present time. Its interior diameter is 22.40 m. (73.47 ft.), and its exterior diameter is 23.90 m. (78.39 ft.) The domes of the largest European observatories, built prior to this one, are far from reaching these dimensions; that in Paris has a diameter of only 39.36 feet, and those of Vienna and St. Petersburgh are 52.48 feet in diameter.

As to the history of this important work; in 1876 M. R. Bischoffsheim, at the suggestion of M. Leverrier, generously gave to the Paris observatory a meridian circle, so long desired by the French savants. But it was found that the soil under this Paris Observatory was unstable, it being undermined by the Catacombs; as a result there was found to be an almost incessant tremor, interfering in an almost insensible but certain degree, with observations, and forbidding the construction on this spot, of a dome of large diameter, built on the former plans, of a circle of wheels rolling upon a fixed wall.

To meet the especial conditions of the case, the Minister of Public Works appointed an especial commission on March 21, 1881, to examine and report upon, or suggest plans, for the construction of a moving dome for the Paris Observatory. Among the seven plans submitted, that of M. Eiffel attracted especial attention from its originality; he proposed to support the entire construction upon an annular float, resting in a concentrated solution of the chloride of magnesium, a fluid heavier than water.

After some opposition from several of the experts, the plan of M. Eiffel was finally adopted, but from lack of appropriation the dome has not yet been built. Charles Garnier, one of the members of the Commission, then recommended the design to M. Bischoffsheim, who had promised the City of Nice an observatory exceeding in size and arrangement any one yet constructed, and an order to build the one now described was issued to M. Eiffel.

The dome itself is a half sphere with a radius of 12.994 m.; it is finished at the bottom by a cylindrical and vertical portion of the same diameter and with a height of 1,044 m., and rests, by means of the float to be described, upon a circular wall enclosed in a very ornate square building, 10.4 m. high and 26.4 m. on a side. Two sets of rollers one on horizontal and the other on vertical axes, permit the dome to rest on the walls independently of the float when desirable, and also prevent any lateral motion from wind pressure; these two systems of rollers are mechanically independent of each other, and they normally have no work to perform.

The steel frame-work of the dome is designed as follows: First there are two great trusses parallel to each other but leaving a space of 10 feet in the clear between them for purposes of observation. Around the circle are other arched trusses, forming sixteen divisions each, cut in two by still lighter trusses; all of these trusses are connected to the vertical base, at the top to the principal trusses. Upon these trusses, covering all except the part reserved for observation, is a roof covering of steel plates very carefully attached.

The annular float, open above, has a rectangular cross section of 1.50m. in height by 0.95m. in width (4.92 ft. by 312 ft.); the sides are well secured by steel bracing to each other. The annular trough to receive this float and the liquid used, has a transverse section of 1.50 m. by 1.20 m. (4.92 ft. by 3.93 ft.) These dimensions in the trough gives to the dome a lateral play of about ⅛ feet The trough rests upon 36 cast-iron supports, which permit examination of almost the entire bottom portion for repairs. The grinding of the dome on a horizontal plane is effected by 18 horizontal rollers carried on an equal number of brackets secured to the dome; these rollers run upon a circular cast-iron track attached to the annular trough.

The slit left for observation purposes is closed by two shutters, each slightly wider than 10 feet, running on rollers between two sets of curved rails; they are worked by endless chains. The dome is moved by the aid of a small fixed winch operating an endless wire cable running upon the circumference of the dome on proper friction rollers. Experiment has shown that a power of 3.78 kilogrammes (7.2 lbs.) applied to the handle of the winch is sufficient to produce motion, but nearly all this power is consumed in overcoming the resistance of the winch and cable. An effort of 3 kilos, (6.6 lbs.) applied to the dome itself without the cable or winch will produce an accelerated motion in the dome.

The liquid in which the float rests could be water were it not that even in the latitude of Nice there is some danger from freezing. In finding a liquid that would not congeal at a temperature below zero, Cen., a saturated solution of the carbonate of potash was first suggested; this will not evaporate, leaves no deposit and has no effect upon either iron or steel; but its cost is relatively high. For this was then substituted, as more economical, the salts of the chloride of magnesium, having the same properties as the potash and costing less money. It is the same solution used in ice-machines of the Pictet type; the solution has a density of 1.25 and only congeals at 40° below zero, Cen.

The total weight of dome and all its fixtures resting on the float is about 95,000 kilos (209,000 lbs.); and this weight in a liquid having a density of 1.20 would require a displacement of about 80 cubic metres. M. Eiffel has given therefore a volume of 100 cubic metres to this displacement, and figures that the float would be immersed just one metre. The quantity of the chloride of magnesium required is 27,000 litres, costing about 1,750 francs.

The weight of the moving portion of the dome is 95,000 kilos (209,000 lbs.); that of the fixed metallic portion is 65,000 kilos (143,000 lbs.); a total of 160,000 kilos (352,000 lbs.) The total surface is 980 square metres covered with 620 sheets of steel 1½ millimetres thick. The weight of each shutter covering the observation slit is 3,500 kilos (7,700 lbs.); the power required to slide them is 44 pounds, and one man can open a shutter in 45 seconds. The shutter can be opened and the dome completely revolved in 3 minutes. At the Paris Observatory the same operation by hand power requires 45 minutes, and by the aid of a gas motor, 10 minutes; the Paris dome is only 48 feet in diameter.—*Le Génie Civil*, May 30.

A Process for making Sea Water Drinkable has been discovered by an English experiment. It consists in using citrate of silver to remove the chlorides. One ounce of the citrate of silver will make a half pint of sea water drinkable. If further experiments confirm this, it is probable all sea-going vessels and lifeboats belonging to them will be provided with bottles of citrate of silver.

Natural Gas in Pittsburg.

Natural gas is now conveyed to Pittsburg through four lines of 5⅝ inch pipe and one line of 8 inch pipe. A line of 10 inch pipe is also being laid. The pressure of the gas at the wells is from 150 to 230 pounds to the square inch. As the wells are on one side 18 and on the other about 25 miles distant, and as the consumption is variable, the pressure at the city cannot be given. Greater pressure might be obtained at the wells, but this would increase the liability to leakage and bursting of pipes. For the prevention of such casualties, safety valves are provided at the wells, permitting the escape of all superfluous gas. The enormous force of this gas may be appreciated from a comparison of say 200 pounds pressure at the wells with a 2 ounce pressure of common gas for ordinary lighting.

The amount of natural gas now furnished for use in Pittsburg is supposed to be something like 25,000,000 cubic feet per day; the 10 inch pipe now laying is estimated to increase the supply to 40,000,000 feet. The amount of manufactured gas used for lighting the same city probably falls below 3,000,000 feet. About fifty mills and factories of various kinds in Pittsburg now use natural gas. It is used for domestic purposes in two hundred houses. Its superiority over coal in the manufacture of window glass is unquestioned. That it is not used in all the glass houses of Pittsburg is due to the fact that its advantages were not fully known when the furnaces were fired last summer, and it costs a large sum to permit the furnaces to cool off after being heated for melting. When the fires cool down, and before they are started up again, the furnaces now using coal will doubtless all be changed so as to admit natural gas. The superiority of French over American glass is said to be due to the fact that the French use wood and the Americans coal in their furnaces, wood being free from sulphur, phosphorus, etc. The substitution of gas for coal, while not increasing the cost, improves the quality of American glass, making it as nearly perfect as possible.

While the gas is not used as yet in any smelting furnace, nor in the Bessemer converters, it is preferred in open hearth and crucible steel furnaces, and is said to be vastly superior to coal for puddling, The charge of a puddling furnace, consisting of 500 pounds of pig metal and 80 pounds of "fix" produces with coal fuel 490 to 500 pounds of iron, With gas for fuel, it is claimed that the same charge will yield 520 to 530 pounds of iron. In an iron mill of thirty furnaces, running eight heats each for twenty-four hours, this would make a difference in favor of the gas of say $8 \times 30 \times 25 = 6{,}000$ pounds of iron per day. This is an important item of itself, leaving out the cost of firing with coal and hauling ashes. For generating steam in large establishments, one man will attend a battery of twelve or twenty boilers, using gas as fuel, keep the pressure uniform, and have the fire room clean as a parlor. For burning brick and earthenware, gas offers the double advantage of freedom from smoke and a uniform heat. The use of gas in public bakeries promises the abolition of the ash box and its accumulation of miscellaneous filth, which is said to often impregnate the "sponge" with impurities.

In short the advantages of natural gas as a fuel are so obvious to those who have given it a trial, that the prediction is made that, should the supply fail, many who are now using it will never return to the consumption of crude coal in factories, but, if necessary, convert it or petroleum into gas at their own works.

It seems, indeed, that until we shall have acquired the wisdom enabling us to conserve and concentrate the heat of the sun, gas must be the fuel of the future.—*Popular Science Monthly*.

How the Sewage of Paris is Disposed of.

La Semaine des Constructeurs quotes from a pamphlet just published by M. Durand-Claye some definite statistics in regard to the Gennevilliers irrigation and the sewerage of Paris, which are well worth remembering. For some reason, the results of the Gennevilliers experiments have been for a long time obscured by a curious indefiniteness, not to say wildness, of statement on the part of those who pretended to have examined them, which no impartial person seemed to think it his business to correct; but the city of Paris has now definitely, committed itself to irrigation as a mode of sewage disposal, and it has become necessary to obtain exact statistics of what has been accomplished, for the benefit of the city engineers, and incidentally for that of the rest of the world.

To begin at the beginning, the entire efflux through the sewers of Paris is ascertained to amount, on an average, to 362,000 cubic meters a day, or about 96,000,000 gallons. This is almost exactly three-quarters of the total amount of water furnished by the aqueducts and the rainfall, the other quarter being carried off by evaporation, absorption into the soil, or by flow over the surface directly into the Seine. All the drainage flow, before leaving the city, is collected into three great intercepting sewers, two of which, conveying 318,000 cubic meters a day, join into one at Clichy, just above a pumping station, where engines of eleven hundred horse power lift a part of the liquid into the pipes, which convey it to Gennevilliers, while the surplus is allowed to flow into the Seine. The remaining intercepting sewer carries 44,000 meters a day by gravitation to the Seine at Saint Denis, but a branch is taken from this early in its course, which conducts a portion of its flow to Gennevilliers, to supplement the main irrigation system.

The main irrigation conduit, which leaves the great double intercepting sewer at Clichy, is of rubble and Portland cement, 49 inches in diameter. After reaching the irrigated field it gradually diminishes in size, throwing off branches, formed of concrete, and varying from 14 to 40 inches in diameter, until it ends in a small pipe, of 20 inches diameter, which serves as an overflow, to carry the surplus liquid of storms into the river. The supplementary irrigation main branches in the same manner over a different portion of the territory, and the filtered effluent is conducted to the Seine by collecting drains. The present area of irrigated land in the Gennevilliers peninsula is 1,430 acres, and the system is continually being extended to new land at the request of the owners. The whole amount of the sewage brought to the peninsula by the drains is 18,000,000 of cubic meters a year, or about 12,000 meters to the acre annually—not far from 3,000,000 of gallons per acre—an amount sufficient, if delivered at once, to cover it all about nine feet deep.

Experiments have been made to determine whether a larger flow could be advantageously used, and for growing beets it seems likely that much more could be absorbed; but for general purposes the present flow is well proportioned to the needs of the ground, and the annual return from the crops is from $250 to $800 per acre, and even more where a cultivator has made fortunate choice of a special product. The rent paid for the land has tripled within a few years, and averages $38 an acre; while the population of the place increases constantly by the arrival of farmers anxious to share in the profits of sewage cultivation. Judging from the results obtained here, the engineers of the city have concluded that 10,000 acres of ground will satisfactorily and profitably purify the whole of the sewage of Paris, and have set about inquiring for suitable territory to that amount. The districts of Acheres and Saint Germain, which have already been condemned and taken for the purpose, will furnish only 3,000 acres, in addition to the 2,000 contained in the Gennevilliers peninsula, so that 5,000 more must, sooner or later, be found somewhere; but there can be no doubt that, with anything like the high rents paid at Gennevilliers, the returns from the land taken for irrigation would make the expense of taking it a safe and profitable investment for the Parisians. It is rather singular that the experiment of sewage irrigation, although rather rudely tried, should have proved so much more successful at Paris than in most places in England, but something is undoubtedly to be allowed for the difference in climate, and the science of sewage utilization will not advance much further until careful investigations are made in regard to this point.—*American Architect.*

Decomposition of Blasting Geletine.

According to Sir Frederick Abel, neither trinitrocellulose nor the less nitrated products are affected, when pure, by a temperature near 100°; but the easy decomposibility of gun cotton, sometimes observed, is due to the presence of nitro-derivatives of foreign organic substances (the incrusting matter of the cellular tissue), which, when heated, quickly decompose with the formation of free acid. In the *Journal of the American Chemical Society*, Professor Charles E. Munroe, U.S.N.A., reports the following case that has occurred under his own observation. Some camphorated explosive gelatine was wrapped in paraffin paper, then in light brown Manilla paper, and laid on a shelf. After something more than a year's exposure, it was found, in the early winter, to be giving off nitrous fumes and to have shrunk considerably in volume, while the outside of the paper was covered with congeries of fine crystals. The odor of camphor was still quite strong. The mass was immediately put into a vessel of water. It was found to be friable, and, after a short immersion disintegrated. The camphor odor soon dissappeared, and the water became of a straw color, gave a strong acid reaction, and showed traces of nitrous acid, but no nitric acid. On evaporation of the filtered liquid, oxalic acid crystallized out in quantity, and an evaporation of the mother liquor on the water bath a sugar-like mass was obtained, which gave the glucose reaction with Fehling's solution. The paraffin was regained unchanged and the paper was recovered, but in a flocculent condition, and with the color bleached from the brown. Careful search failed to reveal the presence of glycerine, nitroglycerine, or gun cotton.

How to Split a Sheet of Paper.

It is one of the most remarkable properties of that wonderful product, paper, that it can be split into two or even three parts, however thin the sheet. We seen a leaf of the Illustrated News thus divided in three parts, or three thin leaves. One consisted of the surface on which the engravings are printed; another was the side containing the letter-press. and a perfectly blank piece on each side was the paper that lay between. Many people who have not seen this done might think it impossible; yet it is not only possible, but extremely easy, as we shall show. Get a piece of plate glass and place on it a sheet of paper; then let the latter be thoroughly soaked. With care and a little dexterity the sheet can be split by the top surface being removed. But the best plan is to paste a piece of cloth or strong paper to each side of the sheet to be split. When dry, violently and without hesitation pull the two pieces asunder, when part of the sheet will be found to have adhered to one and part to the other. Soften the paste in water and the pieces can easily be removed from the cloth. The process is generally demonstrated as a matter of curiosity, yet it can be utilized in various ways. If we want to paste in a scrap book a newspaper article printed on both sides of the paper, and possess only one copy, it is very convenient to know how to detach the oneside from the other. The paper when split, as may be imagined, is more transparent than it was before being subjected to the operation, and the printing ink somewhat duller; otherwise the two pieces present the appearance of the original if again brought together. Some time ago the information of how to do this splitting was advertised to be sold for a considerable sum. We now impart it to all our readers gratuitously.—*Paper Trade Journal.*

A New Explosive.

The new blasting powder "Rackarock," which is manufactured by the Rendrock Powder Co., of 23 Park Place, this city, seems to be giving great satisfaction, to those who have adopted it, as a high explosive. It is formed by the union of two ingredients, solid and fluid, both unexplosive until combined by the user. The following cut shows one method of

combining the ingredients. The porous cloth cartridges are placed in the wire basket and lowered into the fluid, for as many seconds as the diameter of the cartridges require, as per the following table:

For 1¼ inch cartridges, about				3	seconds.
" 1½	"	"	"	4	"
" 1¾	"	"	"	5	"
" 2	"	"	"	6	"

The saturated cartridges are then taken out of the fluid and put aside. They are ready for use in ten minutes after saturation. Enough may be dipped for a single blast, a shift, or a week's work, as occasion may require.

It is claimed that the smoke from this powder is less objectionable than that from any dynamite powders, and far less liable to produce nausea and headache. It is exploded in the same manner as dynamite.

One of its principal merits is safety, both in transportation and use; also, that it will take more tamping and develop fully the strength of nitro-glycerine. It is less sensitive to shock when unconfined than any other explosive, has great rending power, not only throwing out all before it, but breaking the entire mass so that but few block holes are required, and not being affected by cold, avoiding the annoying and dangerous task of "thawing out."

It has been used in a large number of works, and in long tunneling it was found that the men suffered no bad effects from the blasting, as the gas produced is not poisonous and work can be resumed immediately after firing. This was particularly demonstrated on the work at Heligate, and a tunnel on the South Penna. Railroad. It has been used very effectively in firing oil and artesian wells, and, in fact, it is adopted to all purposes where a safe, high, explosive is required. The Company pack "Rackarock" torpedoes for shipping, without mixing, to any part of the U. S., or elsewhere.

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WE wish to obtain complete unbound volumes of ENGINEERING NEWS for 1884, for which we will give a year's subscription to new volume, or we will send, postpaid, a copy of latest edition of Trautwine's Civil Engineer's Pocket Book. We only want one copy of ENGINEERING NEWS and will accept the first offered.

EVERY back number of ENGINEERING NEWS, previous to 1885, now in this office, will be sold as waste paper at the end of the present month. Up to that date we will supply *such as we have* to subscribers *free of charge*; in case no response is made to requests it is sure that we have not the desired number on hand.

THE Legislature of Illinois has just passed an act changing the name of the Illinois Industrial University, of Champaign, Ill., to that of the University of Illinois; thus getting rid of the word Industrial, which while it is good enough in itself is misleading as to the purpose of the institution.

From the catalogue of 1884-5, sent us, we find that this University has a well arranged course of engineering, including mechanical, civil and mining engineering and architecture, extended over a period of two years.

The Exploder is the latest arrival among our exchanges. It is a well printed paper issued by our friend Mr Geo. H. Sampson, of Boston, Mass., in the interest of himself and his customers, in the matter of high explosives, rock-drills, etc. We congratulate Mr. S. on his enterprise and, from our personal knowledge of the man, will back him to run his paper for all it is worth.

WE publish on another page an illustrated extract from the editorial columns of the Pall Mall *Gazette*, a leading London journal, relating to the American Exhibition in London for 1886, to which we will add a few remarks based on our personal knowledge.

Calling at the handsome and well appointed offices of the Exhibition, at 7 Poultry, in the close vicinity of the Bank of England, we met Mr. E. B. Dorsey, Mem. Am. Soc. C. E., of New York, now the Chief Engineer of the Exhibition, and by him was introduced to Director General Whitley, and Secretary C. B. Norton; from these three gentlemen we received many courtesies, and they very freely gave us such information respecting the forthcoming Exhibition as we solicited. We personally visited the site of the Exhibition, and can vouch for its perfect adaptability for the purpose intended; the area under lease is 22 acres; the buildings, originally planned to cover 5 acres, had already been extended to cover 7½ acres, for which Mr. Dorsey was planning the structure. With Mr. Dorsey we crossed over to Antwerp, Belgium, and spent an entire day in inspecting the Exhibition building now open there, in reference to its material, method of erection and its adaptability for the purpose intended; also its sanitary arrangements, and such other improvements as the most recent progress in this class of engineering construction has elicited. The Managers of the American Exhibition are going to have a building as well suited for Exhibition purposes, as the most modern experience in such structures can devise. In the remaining space will be model sugar, cotton and tobacco plantations, with such other displays of American agriculture as it may be deemed advisable to exhibit; also for open air concerts and the other attractions of an Exhibition which requires considerable space.

We were assured that applications for space were already in excess of the most sanguine expectations; no awards of space will be made till in December coming, when the very best representative interests of America will be given the preference with the purpose of securing an exhibit that will be of permanent benefit to exhibitors and most creditable to the country. One conclusion to which we arrived was, that the coming Exhibition is an opportunity that is not likely to be had again for many years, if indeed ever. Looking over the exhibits of machinery and mechanical appliances generally in the Inventors Exhibition now in progress in London, an American cannot fail to be impressed with the vast superiority of the American mechanical genius and its application in improved machinery over that of his British cousin; the Colonial Exhibition of 1886 will be an important event in the annals of British industry, and will bring a vast crowd of interested parties to see it; there will never occur a better opportunity for American manufacturers to exhibit their specialties, and no time should be lost in securing the required space at the American Exhibition for 1886.

THE contractor Buddensiek was on trial last week for his connection with the buildings which fell lately, during construction, on west Sixty-second street, in this city.

Prof. Chas. F. Chandler, of Columbia College, was one of the witnesses, and he presented an elaborate analysis of the "mortar" used by Mr. B. An average of eight samples of the alleged sand employed showed: pebbles, 2.77 per cent.; coarse sand, 25.63: fine sand, 38.02; dust, 38.57. An analysis of ordinary building sand submitted at the same time for comparison showed: pebbles, 2.98 per cent; coarse sand 84.34; fine sand, 9.97; dust, 2.07.

From the evidence it seems that the mortar contained the usual amount of lime, but loam was used instead of sand, and as a cementing material the compound was practically useless. Specimens taken out of the remains of the walls would totally dissolve in water, leaving one ounce of sand to the original five ounces of mortar.

It seems further that Mr. Buddensiek saved just about $300 by his "economy" in the sand required to furnish mortar of a respectable quality. On the other side of the balance sheet, he has human life sacrificed, a pile of ruins and a generally bad outlook ahead.

The defence that he was not a builder by training, and did not know what materials were wanted, is no defence at all. Knowledge of the art of building is a presupposed requisite in a man who personally directs construction; and if an ignorant man assumes this knowledge and thereby jeopardizes human life, self-protection demands his punishment. There are too many structures of like nature in our great cities; many of them standing to-day, rather from force of habit than by any inherent virtues in the material used. This particular set of buildings fell down before it was finished, from a complication of evil practices, bad mortar, light walls, beams of inadequate strength, and as it is said, rock-blasting in the immediate neighborhood. Had these houses been roofed in and their rooms filled with tenants before the final crash, the sacrifice of life would probably have been very great. Yet how many cheaply built houses are there in this city so filled and awaiting the final straw that is to break them down? We must leave the answer to our inspectors of buildings.

The B. & O. in Philadelphia.

The Philadelphia papers are making a very good thing of the present controversy going on between the Penna. R. R. and the Baltimore & Ohio Co., if we can judge by the amount of "paid matter" appearing in their columns.

The engineers of the Baltimore road and the city of Philadelphia had their particular wrangle on Friday, June 12, before the council committee on railroads. Chief Engineer and Surveyor Smedley presented a plan showing an improved location into the city, and explained its workings. Chief Engineer Douglas, of the Baltimore R. R., proceeded to analyze this plan and picked it full of holes, on the subject of cost, grade, etc. It seems that the datum lines of the two disagreed by 8.35 feet, owing to the railroad company bringing their levels from Baltimore; this discrepancy interfering materially with the crossing of the Schuylkill River as proposed by Mr. Smedley.

The main point at issue is the manner of crossing the streets near the Green street entrance to Fairmount Park. Statistics regarding this entrance were rained upon the heads of the committee by the rival lawyers and engineers; 404,603 vehicles passed in there last year, together with about 1,159,360 pedestrians at Green street, and 690,230 at the Fairmount avenue entrance. Tunnels and bridges and elevated roads, with grades of five and six feet per hundred, were suggested by the engineers in a rather bewildering sequence. The discussion, charges and counter-charges, between lawyers, committeemen and rival engineers, make the voluminous reports of the day's proceedings lively if not very edifying reading. The end is evidently not yet.

Panama Canal.

The last report of work done since Jan. 1. 1885, in the *Bulletin du Canal Interoceanique*, of June 1st, is:

In January, 1885	550.000 cu. metres
" February, "	590.000 " "
" March, "	627.000 " "
" April, "	775.000 " "

Annual Report of the City Engineer of Boston, Mass.

The Annual report of the late City Engineer H. M. Wightman, of Boston, Mass., was submitted to the Board of Aldermen on June 2nd. The expenditures for engineering in the department were $21,971.39 to Jan. 1, 1885.

The report contains the following on the proposed bridge to Cambridge:

The bridge is to be 70 feet wide, excepting at the draw, which is to be fifty feet wide. Commencing at the harbor commissioner's line, at the Boston side of the river, the bridge, for a distance of about 200 feet, is to be a wooden-pile structure, with stone paving, it being thought best, in view of the probability of the extension of the Charles river embankment, to cover the space to be occupied by it by a structure of a somewhat temporary character. From the end of this 200 feet of pile bridge to the harbor commissioners' line on the Cambridge side of the river the bridge will consist of iron spans supported on stone piers, and the bridge will be a deck-bridge, with the exception of the draw-which will have two main trusses above the floor.

The general piers will be of stone masonry on pile foundations, the piles to be cut off at three feet below low water, and to be inclosed by sheet-piling. The top of the coping of the piers will be at grade thirteen feet, and stone bearing-blocks will be placed under girder-bearings, bringing the lowest point of the iron-work of the main girders at grade 16 feet. The draw foundation will be circular in shape, and of stone masonry, resting on a foundation of piles filled between with cement concrete, the concrete extending to hard bottom. The piles and concrete are to be encased in a curb of sheet-piling. The fixed spans of the bridge will be generally in alternate spans of about 74 feet and 105 feet. 75 feet of the longer span to be carried by independent girders, supported by cantilevers from adjacent spans. The flooring of the entire roadway will consist of hard-pine stringers supporting two courses of spruce plank; the under course to be 4 inches thick, treated by the kyanizing process, and the upper course to be 2 inches thick. The sidewalks will be made of hard-pine stringers, carrying a walk of white-pine plank, or tar concrete, as may be desired, the walks to be guarded by heavy cast-iron curbs, provided with draining scuppers. The draw, which is to span two channels, each 36 feet wide, will have two main trusses of the pin-connected type, and will be carried on a wrought-iron turn-table of improved construction. It is to be operated by steam-power; and a suitable building for the machinery, and for quarters for the bridge men, is to be provided. The clear head-room between the water at grade 12 feet, and the under side of the bridge will range from 4 feet at pier to 7 feet at mid span. Under the draw this head-room will be increased to 12 feet.

The average daily consumption of water for the year 1884 was: from the Sudbury and Cochituate works, 25,090,500 gallons; from the Mystic works, 6,209,700 gallons; total, 31,300,200 gallons.

Under the head Waste of Water is shown a steady reduction in the consumption due to the waste-prevention methods introduced in 1883. The average consumption in 1883, per head, was 91.5 gallons; in 1884, this was 68 gallons, the saving effected representing 25.6 per cent. In July and August of 1883 the demand per head was 102.4 and 103.3 gallons respectively; in 1884 for the same months, it was 68.9 and 67.7 gallons showing a saving of 33.5 and 35.5 gallons per head for those months. Sixty three Deacon meters were added in the year, making 69 now in use; 5,000 sidewalk stop-cocks have been ordered to facilitate the working of the house-to-house inspection system.

The improved sewerage is reported as acting well; during the past year nearly all of the sewage of the city south of the Charles River has been discharged at Moon Island. Examinations made at points along the shore and docks where the water was formerly very foul from sewage matter, shows that at these points the water is now pure, bad odors have ceased, and fish have returned to points avoided by them for years. One of the Leavitt Engines at the Pumping Station easily controls the flow of sewage, except in case of heavy rains when the second engine, or the Worthington pumps are started. The average daily amount of sewage pumped has been about 23,500,000 gallons.

The tank-sewers leading to the west shaft of the Dorchester Bay tunnel are fully accomplishing the purpose for which they were erected; *i. e.*, the interception by deposit of all sludge passing the pumps. Fully 2000 cubic yards of this matter have thus been arrested, and nothing but the lightest kind of flocculent mud reaches the tunnel. A plan has been put into operation by which the sludge is made to flow by pipes from the deposit sewers into a large tank on a pile foundation alongside the channel leading to the pumping station. Dump-scows are loaded from this tank and then towed outside the harbor for emptying. The tunnel was not flushed until it had been in use eight months, at which time it was estimated that 2 feet of soft mud had been deposited in it. When it was flushed, the four pumps were worked simultaneously, and a velocity of flow of 3½ feet per second maintained in the tunnel for some hours. A similar flushing is now resorted to about once in two weeks, sea-water being used for the flushing.

The reservoir on Moon Island has proved large enough for present needs; it holds 25,000,000 gallons, and as the sewage is only held about 10 hours, the daily storage capacity, exclusive of sewers, is about 60,000,000 gallons.

The effect of discharging the whole sewage of the city at the Moon Island Outlet has been watched with great interest. Besides other waste products, each day's supply of sewage contains over 200 tons of fecal matter. The outlet sewers extend about 500 feet into the sea, and between the embankment covering them and the island is a cove of still water. A foot or more of sludge has been deposited in this cove by eddies. To the south of the outlet, for a distance of about 1,000 feet, an inch deep of mud is apt to accumulate on the beach between low and half-tide levels. This latter deposit is from time to time washed away by the waves. By the expenditure of $25,000 a bulkhead can be built which will prevent the return of the sewage to the points now affected by it. It is also possible that sufficient relief may be afforded by some gates which have just been placed at the outlet sewers' mouths. Although the reservoirs have been emptied at about the beginning of ebb-tide, the low discharge and outlet-sewers themselves were only emptied slowly as the tide fell. The action of the gates, before referred to, will be to retain the last million gallons of sewage, containing the scourings of the reservoir, until the succeeding time of discharge, during the early ebb-tide.

The report contains a number of items relating to the practical working of the Improved Sewerage scheme that are both interesting and valuable. At the filth-hoist, at the lower end of the main sewer, all refuse matter more than one-inch in diameter is caught by the screens and retained. The average daily yield of this matter is about 16 cubic feet; but when a heavy rain dislodges deposits in the city sewers this quantity is sometimes increased ten-fold. This screened matter is now compressed and burned under the boilers without any apparent injury to the fires.

The total amount of sewage pumped is probably more than 15 per cent. in excess of that due the city water supply. This excess comes from the Jamaica Pond Aqueduct water; private water supplies in dwellings, breweries, etc.; soil-water which leaks into the sewers and from tide-water entering by some of the old sewers.

In the tunnel under Dorchester Bay the velocity of flow was very slight for the first few months of 1884, often less than half of a foot per second; this was before many of the city sewers were intercepted. At present the ordinary velocity of flow is generally less than one foot per second. As the sewage thus takes from two to four hours to pass through the tunnel, some slight deposit undoubtedly does occur. The flushing methods resorted to have already been mentioned.

While it is probable that the tunnel can be kept reasonably clean by flushing only, Mr. Wightman did not believe it safe to be left without means of access. For this purpose a large mining pump, already purchased, will be put into the eastern shaft, which can empty the tunnel in 48 hours. As the tunnel can be first filled with sea water, its contents can be pumped into the Bay without causing offence. The city sewage can, in the interum of cleaning be emptied at the old city outlets, unless the special statute forbidding its discharge at the west shaft of the tunnel be rescinded.

In the supplementary report of Eliot C. Clarke, the Engineer in charge, is shown a device for stirring up the sludge in the bottom of the deposit sewers, in connection with the 6-inch pipes for drawing off this sludge into a tank, mentioned before. This floating scraper consists of a raft made of 12-inch iron cylinders, to the bottom of which is hung a wooden apron somewhat less in width than the sewer. The apron is weighted at the lower end and is provided with broad iron teeth which sink into the sludge somewhat. The current in the sewer carries this scraper along and materially assists the flushing process.

The expenditures for 1884 amounted to $745,289.77, which, with previous payments, makes a total expenditure of $5,168,456.91, and leaves a balance from the appropriation of $84,543.99.

The Tower Bridge Plans in London.

A correspondent of the London *Engineer*, in the issue of June 5th, makes a few very sensible remarks upon the much discussed proposed Tower Bridge across the river Thames. As is well known many plans, all of them odd and some very peculiar indeed, have been suggested for meeting the requirements of this particular case; i. e. a low-level bridge, and one at the same time offering as little obstruction to shipping as possible.

Two plans have been offered which were supposed to solve the difficult problem. One was a light bridge in two leaves over the channel, with wells in the piers and a tunnel connecting these piers under the bed of the river; the other proposed to erect two high towers connected by an arched span giving headroom sufficient for vessels and having elevators in the towers. Both of these designs were intended to accommodate the foot passengers only; vehicles would have to await the closing of the draw-span proper.

The correspondent referred to analyses the practical working of each of these schemes and contrasts them with the use of a swing draw of the ordinary type costing but one half as much as those proposed. He shows that in the first case the average foot passenger would rather wait a few minutes than to climb down and up 300 steps and pass by a tunnel to the other side—that he would probably save time, and certainly some muscular effort by so doing. In the other case, but 36 persons at a time could be lifted up on the tower elevators, and supposing the draw to be open for twenty minutes, an extreme case, only 252 people could be accommodated by the lifts in each direction; a result which hardly warrants the stupenduous structure and heavy outlay by which it is effected, and the lifting of 400 tons of dead weight an average height of 50 feet every time the draw is opened.

The writer says that the one objection to the simple and usual solution of similar problems suggested by him, is the fact that it contains nothing novel, and will cost comparatively little money. But taking the figures given by the rival projectors as a basis of comparison, the plan of the correspondent of the *Engineer* certainly has common sense to back it. The more complicated plans suggested, forcibly illustrate the two common errors among engineers, of losing the direct point at issue in the attempt to introduce some novel but wonderfully intricate plan for doing what is after

all a very simple thing; to follow the by-ways of elaborate mechanical construction, instead of sticking to the highway of common sense.

Street Cleaning and Garbage Removal in New York.

We reprint from our cotemporary, *The Sanitary Engineer*, a description of the method of street cleaning and garbage removal, as practiced in New York City. The matter was obtained from official sources by the *Sanitary Engineer* in answer to a query from the Mayor of Kansas City, Kansas.

Through the courtesy of the Department of Street Cleaning of New York City we have obtained the data which enable us to give the following reply:

The cleaning of the streets of the entire city—both Manhattan Island and the annexed district—is under the direction of the Department of Street Cleaning. This is an independent department of the city government, the head of which, known as the Commissioner of Street Cleaning, is appointed by the Mayor with the approval of the Board of Health.

The work of cleaning the streets is done in part by contractors and in part by the city itself. That portion of the city below Fourteenth Street is cleaned by two contractors, one taking the region east and the other west of Broadway. These two districts include by far the larger part of the business area of the city, with the heaviest traffic and most crowded streets. The distance from Fourteenth Street to the Battery is about two and three-quarter miles. The greatest breadth of this part of the city is about two and one-half miles. The district of the two contractors contain about 125 miles of streets. All the rest of the city is cleaned by the force of the department. The contractors employ at this season of the year about 200 laborers and the same number of one-horse carts, the department about 300 laborers and an equal number of carts. The number of carts varies with the season, a heavy fall of snow in the winter requiring both the department and the contractors to hire temporarily many additional laborers.

From spring until fall, or rather in those parts of the year when ice and snow do not require to be dealt with, the sweeping of the streets is done chiefly by the sweeping-machines, manufactured in this city by the Chapman & Neil Manufacturing Company. Of these machines, which are either one-horse or two-horse, the city owns 25, the contractors 20, most of them being one-horse machines; and as many of them work both night and day, the equipment all told is considered equal to 65 machines. As the machines move through the streets the revolving brushes sweep the dirt into the gutters, where the laborers heap it into piles, to be loaded into carts and taken to some one of the fifteen dumps which the city has along the water-fronts.

Almost all the sweeping is done at night. The rest of the work is usually done by day—in the busiest streets, as far as possible, in the early hours of the morning. At this time of year the laborers may be at work gathering the materials into the carts by four o'clock in the morning. South of Chambers Street on the east side, however, all of the labor is performed at night, and, of course, the sweeping of Broadway. The intervals at which the streets are cleaned vary with the conditions of the parts of the city. About 10 miles of down-town streets are cleaned every day; every alternate day about 160 miles are cleaned, 100 miles twice a week, and the remaining streets once a week. There are in all at the present time about 340 miles of paved streets in the city. This amount is steadily increasing with the growth of the population and carrying out of improvements in the up-town region.

The removal of the garbage and ashes is under the same authorities as the cleaning of streets—the contractors in the down-town districts and the force of the Street Cleaning Department in the rest of the city. If the provisions of the Sanitary Code were enforced it would be incumbent on the citizen to put his ashes and garbage into separate receptacles, and the city and contractors would be prevented from carting away mixed loads of these materials in the same carts; but practically these provisions are a dead letter—garbage and ashes are thrown into the same boxes, barrels, cans, or whatever is handy, and all goes into the same cart. Some years ago, when the streets were cleaned by the Police Department, an attempt was made to induce people to separate their ashes and garbage, and separate carts were sent for each, but the attempt failed.

For removing the mixed garbage and ashes, routes are established of such size as to occupy one cart, or in some cases two carts, daily. The drivers of these carts are required to visit every house on their routes each day, and to go their rounds always in the same order, so that the householder will know about what time to expect the cart and have his receptacle placed on the sidewalk.

It has been mentioned that the street sweepings go to the dumps. These are also the destination of the garbage and ashes, but as the collections contain tin scraps, old bones, and other material which can be turned to account, the city has made contracts with certain parties who pay for the privilege of sorting out such materials at the dumps. The laborers employed by these contractors also "trim" the city's barges.

At the present time there are gathered daily about 1,000 loads of street sweepings and 3,000 loads of ashes and garbage.

The city has not as yet attempted to institute any system of burning garbage or of disposal, other than conveyance out to sea and dumping in deep water, as the law requires. Under the present system the city owns 23 deck scows, and hires 10 "self-dumpers" which are loaded at the dumps and towed out to sea by the two steam-tugs owned by the city and used for this purpose. By law these scows cannot dump their contents in any part of the harbor of New York, but must go out to the open sea—a provision which, it is common rumor, is often evaded in stormy and foggy weather.

The Department of Street Cleaning has the work organized as follows: The streets are cleaned by police precincts, of which there are 14, and to each is appointed one foreman. The contractors organize their work in a similar way and employ about the same number of foremen. With each foreman the city places an assistant foreman; at each dump there is an inspector, in all 15, and an equal number of night watchmen.

The city owns its stables and about 100 horses and carts. Horses in addition to its own are hired as needed. Finally there are the crews of the two tugs and the mechanics at the stables. In the office of the department are the commissioner, the deputy commissioner, superintendent, assistant superintendent, three district superintendents or inspectors, the superintendent of tugs, and the superintendent of stables. Then there is the clerical force. The appropriation for the department last year was $1,050,000, all of which was expended. Of this sum $367,490 was paid to the two contractors. For 1885 the appropriation is the same, with the addition of $150,000 to be used in case of cholera appearing.

As there are almost no wood pavements in the city (the only bit being a block on Fifth Avenue) the question as to the sanitary effects of sprinkling has not come before the department. Almost the entire street pavement is now Belgian and oblong granite block known as the Guidet block. There are a few blocks of asphalte, however. The sprinkling is not done by the city, but by private parties, to whom the city sells water at low rates. These parties then get their recompense by charges on the abutters on the streets who are willing to pay for the convenience of the sprinkling.

The creation of the Department of Street Cleaning was due to a popular agitation in the spring of 1881. The present commissioner is Mr. John S. Coleman, and the condition of the streets is a great improvement over that which existed under the preceding system, when the cleaning of them was a part of the duties of the Police Department.

Metallic Ties in France.

At the meeting of the French Society of Civil Engineers, in Paris on April 24, after the reading of M. Auguste Moreau's comments on Metallic Ties in Holland (see last issue ENGINEERING NEWS,) M. Contamin made some further remarks on the subject as bearing upon their use in France.

M. Contamin thought that while the subject of metallic ties had been studied for twenty years, no solution had been arrived at sufficient to convince many engineers that it was to their interest to substitute iron or steel for wooden ties.

The pressure between the rail and tie, in wood at least, is very considerable and may reach 1420 pounds to the square inch when the contact between the two is direct. No ballast would support this pressure, and the object of the tie is to spread it, so that it will not exceed the limits of resistance of the material used in the ballast. On the Northern railroad of France, with express trains in use, the wooden tie is 8.2 feet long, 10¼ wide, and not less than 5 inches thick under the rail. As the stability of the roadbed is altered as these dimensions are decreased, it would seem that the pressures corresponding to these dimensions should be considered as extreme limits, not to be exceeded in any system of uniting the rail to the ballast.

From this standpoint many engineers believe that the pressure is too great in many types of metallic ties. If we could make use of a ballast sufficiently hard and capable of being packed in the hollow tie so as to form a monolith, the conditions would be materially altered; but a ballast of this character is not to be found everywhere.

The great obstacle to the introduction of a metallic tie lies in its cost; for with ties weighing only 100 pounds the price is too great for its adoption on the French railways, putting aside all considerations of the requirement of a ballast of a special character. Metallic ties weighing about 100 pounds could not be secured in France for less than 9 or 10 francs; while creosoted oak or beech ties, on the Northern Railway, cost about 5 francs, 50 cent, and they last about twenty years. It is evident then that even with the lasting qualities attributed to iron ties there is little inducement, from an economic standpoint, to substitute them for wood. The speaker thought that the metallic tie should weigh more than 100 pounds to give it the same surface of resistance as in the wooden tie.

There are other elements to be considered in advocating any change in the system; there are upon French railways 60 million wooden ties; and fixing the mean life of these ties at 20 years, about 3 million ties per year would have to be replaced. If this replacement was made with metallic ties at least 150,000 tons of metal would be annually required, a quantity that could not be at once secured from French works. Such a substitution would give rise to a circulation of 1,500,000 tons of merchandise, with augmented salary account, etc., all of which would fall upon the railway companies. M. Contamin admitted that the conditions as given for France did not hold good in the colonies, where wood will not last so long and is more difficult to secure.

Street Cleaning with Salt Water.

Last week the scheme of Fire Commissioner Purroy was tried for cleaning the filthy streets of this city with salt-water, at least the streets nearest the water-front. The operation was performed by filling a moveable tank of 4750 gallons capacity by a line of two 3½ inch hose, 1100 feet long, running from the fire boat Zophar Mills. From the tank two other hose were run 750 feet further inland, and water was forced through these by a fire engine stationed at the tank.

As a result, in less than 15 minutes the streets experimented upon were flooded with water, the surplus running off in the sewers and the mud and slush cleaned up by a force of street sweepers. The scheme was regarded as successful, accomplishing a good purpose without the consumption of a large volume of the more precious Croton.

A Fume Condensor.

Mr. A. O. Walker, of Chester, England, has made a novel application of electricity to the arts and manufactures that promise to have a very considerable value. It is the condensation by an electric current of the fumes escaping from the smelting of lead and zinc oxide and in the manufacture of arsenic.

Prof. Lodge of Liverpool, in a lecture last year upon "Dust" exhibited the curious effect of the discharge of high-tension electricity into a vessel containing the fumes of magnesia, smoke of burning paper, cigar-smoke, etc. The introduction of a metallic point in the experimental bell-glass and the connection of this point with one of the poles of a good frictional, or induction, electric machine causes the magnesia smoke to at once take up a whirling motion and to rapidly deposit in large flakes upon the sides and bottom of the glass. The smoke was completely cleaned away in a few seconds, whereas hours would have been required to accomplish the same result in the ordinary course.

A report of this lecture having reached Mr.

Walker, who is one of a firm of lead smelters and manufacturers, he at once conceived the idea that this newly discovered property of electricity could be utilized in dealing with the condensation of lead fumes issuing from his furnaces. He communicated with Prof. Lodge, and experiments were at once commenced at the works at Bagillton on a practical scale.

A large wooden flue was constructed with casks leading from one of the main flues of the works; dampers were put into this tube so that it could be completely closed and glass windows were provided to observe effects. The electric machine used was of the Voss system with 18 inch glass disc; inside the tube were placed the discharge-points, several kinds being tested, and these points were connected by an insulated copper wire passing through a glass tube in the side of the flue with the battery. At first the flue was filled with the lead fumes and the dampers closed so that all within was in a state of rest; the electric machine was started and the same action took place as in the magnesia in the bell-jar; the whirling movement around the discharge points and the deposit of flakes, and in a very short time the "fume" had entirely disappeared.

The experiment was then made on the fumes in rapid motion by turning all the fumes from the works through the improvised flue. The effect was practically the same as before, the flakes falling almost at the mouth of the tube. The experiments seemed to show that the more points used and the more equally these were spread over the cross section of the tube, the more efficient the electric effect. The cost of this condensation process is very moderate.

The Hartsfeld Portable, Steel, Water-Jacketed Blast Furnace.

Plans and a description of this furnace have been sent to us by the inventor, Mr. Charles L. Hartsfeld, now of Newport, Ky. It is a portable blast furnace intended for smelting iron, copper, galena, silver, gold, nickel and other metals.

In construction it is so simple as not to require an illustration; the furnace is a double cylinder, one within the other, with a space between the two parts, through which water is continually circulating. The inner cylinder can expand or contract without injury, or needed repair from this cause. The bottom portion of the inner cylinder is lined with refractory material, and the smelting process is confined to that portion alone as the upper part of the furnace is never hot enough to burn the coke or wood fed into it. A very powerful blast is used in smelting.

Engineering says: "This Scotch hearth reverberatory, a Siemens' type-like furnace, much improved by Mr. Charles L. Hartsfeld, a practical expert and builder, has been and is in constant operation throughout Europe, always remains round and smooth throughout, which is a very important feature, also with regard to economy of coke and other fuel, it is likewise unaffected by any chemical action by the fact that the furnace admits of an addition of any quantity of basic substances without any risk of damage."

The cost of reducing ore in a No. 4 water-jacketed furnace of 50 tons capacity in 24 hours is given as follows:

Pine wood, 10 cords at 9 marks a cord, 90 marks, equal	$22.50
10 laborers, at 3 marks a day, 30 marks, equal	7.50
2 engineers, at 6 m. 40 pfenige, equal	3.80
4 teams, at 8 marks a day, 32 m., equal	8.00
Extras daily, 38 marks, equal	9.50
Total cost per 24 hours, 203 marks 80 pfenige	$51.00
The value of the ore per ton is	$72.00
The daily capacity, 50 tons, makes	$3,600

Deduct cost of smelting, $51, leaves a daily net profit of $3,549 or 14,196 marks.

The total weight of a 50-ton furnace set up complete is 12,400 pounds, and its size 7x29 feet.

The capacity of the smallest furnace built is five tons in eight hours, and its weight is 1,600 pounds. Its size is 2 feet 3 inches in diameter by 7 feet 6 inches in height.

These portable blast furnaces will be constructed in Cincinnati foundries ready to be sent to the mines. Experts claim them to be invaluable, as there are no brick used in the construction, and they can be easily transported over the mountains where ore lies in scattered masses, mined by nature itself.

Mr. Hartsfeld had already won fame as a builder of furnaces in Europe, and the merits of the present devices have already been recognized in many of the Continental countries: and it is now being introduced into England, Australia, South America and the United States.

PERSONAL.

W. W. RITCHIE, for more than twenty years secretary of the Mexican Railway Co. died in Madeira lately.

T. J. NICHOLL is appointed General Manager of the East and West Railroad of Alabama, with headquarters at Cedartown, Ga., vice John Postell, resigned.

GENERAL MANAGER A. A. ROBINSON, of the Wichita and Western Kansas Railway, has resigned, and Frank M. Hill has been appointed Superintendent, Freight and Passenger Agent of the same road.

JEROME B. CABLE has been reappointed Superintendent of the Rocky Mountain Division of the Northern Pacific R. R. F. W. GILBERT, the present Superintendent is transferred to the Cascade Division.

JOHN C. GAULT assumes the duties of the General Manager of the Cin. N. O. & Texas Pacific R. R. on July 1, in place of John Scott resigned. Mr. Gault is at present abitrator of the western trunk lines with headquarters at Chicago.

LUTHER WRIGHT, one of the oldest and most prominent citizens of Oswego, died June 9, aged 86 years. For 50 years he was engaged in many extensive business enterprises in Oswego. He was one of the builders of the Oswego & Syracuse Railroad and was interested in iron works, mills and gas works.

VICE PRESIDENT THOMAS C. PURDY, of the National Railroad Company, the resident General Manager here has resigned his office, to take effect June 1, when he will be succeeded by Mr. David C. Dodge, formerly Manager of the Denver and Rio Grande Railroad, and a railroad official of ability.

JAMES L. SHAW, of Philadelphia, a well-known telegraph contractor and builder, died suddenly of apoplexy on the street June 9. Mr. Shaw, who was 62 years of age, has been identified with various telegraph companies and was the contractor for the first telegraph line built between Washington and New-Orleans.

A. M. HAGER and J. B. VANDYNE having resigned, respectively, as superintendents of the Missouri Pacific and the Missouri, Kansas & Texas railways, the offices have been consolidated, and E. K. Sibley has been appointed superintendent of the Missouri Pacific Railroad, with headquarters at Sedalia, Mo. The office of assistant to the third vice president, which Mr. Sibley has filed for some time past is abolished.

MR. GEORGE H. FROST, of this journal, returned from Europe by the steamer City of Chicago on the 13th. Among the many objects of interest visited by Mr. Frost in his hurried trip were the Inventions Exhibition in London, the nternational Exhibition in ALTwerp, Belgium, and the Forth Bridge, near Edinburg, Scotland. Both Exhibitions are so very attractive in their display of novelties that considerable time could be profitably spent in their inspection. The progress of the Forth Bridge has been fully described in preceeding numbers of this journal, and will be in the future as the official reports of the Engineers are published.

THOS. J. LONG, C. E., since 1873 connected with the Department of Docks of the City of New York, resigned his position on May 25th, to accept the duties of Engineer of the Morse Bridge Co., of Youngstown, Ohio. In forwarding the resignation to the Dock Board, Chief Engineer G. S. Greene, Jr., bears strong witness as to the energy, faithfulness and always good and satisfactory work performed by Mr. Long, and adds that the city has lost a valuable and efficient officer. Mr. Long has had immediate charge of much important work in the Department of Docks, and the Bridge Works is to be congratulated in securing his services.

MR. WILLIAM H. WILEY, of the well known publishing firm of JNO. WILEY and SONS, returned from Europe by the steamer City of Chicago on the 13th. MR. WILEY was eminently successful in placing many of the justly popular engineering and other publications of his firm in the London market: his personal recollections of the perils and pleasures of ocean and European travel, were apparently very agreeable, judging from his good natured look at the Barge Office on day of landing. He thinks London and Paris are good enough towns in their way, but New York "is good enough for him" as a place of business.

THE CASCADE DIVISION of the Northern Pacific, from Pasco Junction, the intersection with the main line, to North Yakima, eighty-six miles, will be turned over to the operating department June 1. F. P. WEYMOUTH will assume charge of the new division as superintendent, with headquarters at Sprague. S. C. PROWELL will be assistant superintendent, and will have his headquarters at North Yakima. The jurisdiction of F. C. KIMBERLY superintendent of the Minnesota division, will be extended June 1 so as to include the Wisconsin division, which will also be turned over to the operating department on that date. WADE CONVERSE has been appointed assistant superintendent and road master, and J. P. BARTLETT agent for the company at Ashland.

JAMES HENRY RUTTER, late President of the New York Central and Hudson River Railroad, died on June 12 at his country place at Irvington on the Hudson. Mr. Rutter was born February 3, 1836, at Lowell, Mass., the son of E. Rutter; for many years superintendent of the Old Colony R. R., and the first superintendent of the Susquehanna division of Erie R. R. Young Mr. Rutter was educated at the Schofield Commercial College, and in 1854 accepted a clerkship on the Erie road at Elmira. From April, 1855, to November, 1857, he was chief clerk in the freight office of the Williams port & Elmira R. R. at Williamsport, Penna. He then took a similar position on the Mich igan Southern and Northern Indiana R. R. but in 1859 returned as agent of the Erie R. R., at Elmira. In 1866 he became general freight agent of the Erie, and here first gave evidence of his peculiar ability and knowledge in the conduct of freight traffic. In 1871-72 he attracted the attention of W. H. Vanderbilt by his testimony before a Senate investigating committee, sitting at that time, and Commodore Vanderbilt was induced to engage him as general freight agent of the N. Y. Central R. R.

From this start he rose rapidly; in 1877 he became general traffic manager and a director of the road: in March, 1880, third vice-president and on May 4, 1883, he succeeded Mr. W. H. Vanderbilt as President of the N. Y. Central R. R.

ENGINEERING NEWS Three months for One Dollar.

Engineers' Club of Philadelphia.

Record of special business meeting, June 6th, 1885. Past President Frederic Graff in the chair; 31 members present.

The Secretary reported from the Board of Directors that arrangements had been finally concluded with the Girard Estate, and that the building at No. 1122 Girard Street is to be occupied by the club for a term of five years, at an annual rental of $1,000 the Girard Estate to expend $1,000 in making the alterations and repairs desired by the club.

The By-Laws, as reported by the committee on revision of the same, were then taken up and discussed in detail. Two amendments were made, and the revision, as thus amended, was offered in regular form as amendment to the present By-Laws. It may be said that the new By-Laws, if adopted, will make no change in the present general policy and practice of the club.

The Secretary presented a communication from Mr. Wm. T. Blunt, Secretary of a Committee appointed by the Civil Engineers' Club of Cleveland to investigate the relation of Army and Civil Engineers in the Government service, and report a line of action in the premises. The communication requested that a similar committee be appointed by this club. On motion, the consideration of the subject was postponed for the present.

On behalf of Prof. Louis H. Barnard, M. Dana C. Barber presented an illustrated article upon Stereographic Projection, which, being entirely mathematical, does not admit of presentation in abstract.

Mr. Percy T. Osborne presented an illustrated description of the Sand Bag Embankment to close Little Inlet on Brigantine Beach, N. J., which was constructed by his father, Mr. Richard B. Osborne, C. E.

The closing of this Inlet, the width of which was 831 feet, with a rapid current at ebb and flow of tide, never was deemed possible with the very fine sand which was the only material at hand.

The changing character of this shore, under the action of the northeasterly winds, the laws of nature and the results they had in years past produced on this beach, the possibility of making these co-workers in producing like results in a shorter period of time, supplied the only expectation that, with the means possessed, this water-way could be obliterated, and a large area of land redeemed from the sea.

By closing this stream for a *short period*, it was expected that the sea would form rapidly what it would require perhaps a century otherwise to accomplish, and that the accretion from the sea would quickly protect and cover up the works of construction, without which it was utterly useless to attempt to build a barrier against the ocean, out of the material available. The expectation has been proved to have been founded on correct principles. The sea has performed its part most fully. The operations of nature's laws have been quickened, and the Inlet, to-day, is a thing of the past. The sand was packed in ordinary salt bags, costing 5½ cents apiece, sewed up and placed in the embankment, at a cost of 66 cents per cubic yard for bags, and 34 cents per cubic yard for filling, sewing and placing, making a total cost per cubic yard of one dollar. The working hours were between half ebb and half flow of tides. The embankment was made from each shore simultaneously, to within a foot of low water, by placing the bags by hand. On these bags, frames, 6 feet in height, 12 feet broad on top, and 8 feet apart, were placed, and connected by planks spiked on the sloping sides. The interior spaces were filled with sand-bags, 80,000 of which were used in the construction of the embankment. About 1,050 were placed in a day of 10 hours, 12 of them equalling 1 cubic yard. At low tide, the water in the main channel was 13 feet deep when the bank was begun, on June 17th, 1881. On the 5th of August following, the embankment was closed and the sea shut out—in 42 working days,—and where the deep channel had been, there was then less than 2 feet of water; the deposit of sand from the sea having commenced with the embankment and increased as it progressed. For 9 days after closing, the embankment withstood the heavy seas and south-easterly gales.

On August 12th, the sea broke over the banks near the north end, where the water was 2 feet deep. Having some bags on the ground, this breach was closed on the next ebb-tide. On the 14th another breach occurred, when there was nothing at hand for its repair, the bags ordered on August 6th not having been supplied for 18 days. When they did arrive, the company had discharged the contractor, and the breach had only to be left to itself. It continued to widen up to 16th September, when it was 132 feet, with 16 feet depth, of water below the original surface. The old 13 feet channel remained closed, and three bars from the bank seaward had been created. It was expected then that the accretion would still continue, and that finally, in spite of the breach, the closing of the original channel and the alteration of the course of the tide would continue the deposit and finish the undertaking, without further efforts. Something was attempted afterwards by one of the company—by driving poles and stretching light wires along them,—but these petite attempts conduced in nowise the ultimate result. The increased action of the sea finally obliterated the Inlet, and covered the whole locality, thus proving that nature had fully performed what had been expected of her—70 acres seaward and 30 acres inside were reclaimed.

Owing to the lateness of the hour, the reading of the other papers was postponed.

HOWARD MURPHY,
Secretary and Treasurer.

Missouri Surveyors and Engineers.

The Fifth Annual Meeting of the Missouri Association of Surveyors and Civil Engineers was held in the rooms of the Engineering Class of Missouri University, Columbia, Mo., on the 4th, 5th and 6th inst., with an attendance of delegates representing nearly every portion of the State. Vice President, G. C. Pratt, State Railroad Commissioner, presided, Prof. T. J. Lowry, Secretary.

The following new members were elected: S. W. Hammack, of Montgomery; F. H. Hoffstrom, C. E., of St. Clair; J. S. McClearey, of Montgomery; A. Andrews, of Nodaway; J. A. Wilson, of Lexington; H. Krause, of Lafayette; O. P. Devin, of Shelby; W. S. Williams, C. E., of Johnson; J. S. Alexander, C. E., of Lincoln; R. H. Phillips, C. E., of Boone; D. T. Polk, of Platte; F. Sterne, C. E., of Columbia; B. B. Beery, of Cameron; G. P. Clark, of Morgan; W. R. Painter, of Carroll; E. E. Smith, C. E., of Jackson; J. T. Grigsby, C. E., of Monroe; G. Butler, of Gentry; T. C. Hughes, C. E., of Caldwell.

The chair appointed H. C. Shields, T. H. Halley, J. A. Swetnam, J. W. Riley and G. H. Roberts a committee to consider and report on questions concerning land corners, roads and bridges to this convention.

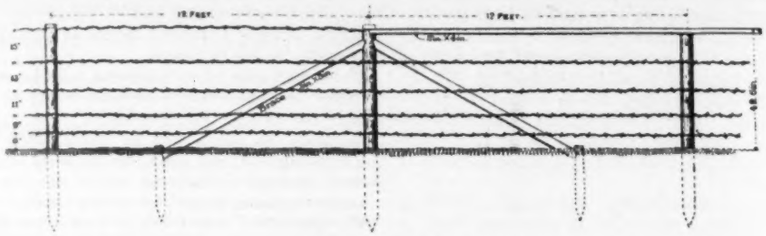

FIG. 94.—WIRE FENCE.

The following papers were read and referred to the Committee on Publication: "Old Corners of County Surveyors,—What weight shall attach to them?" by S. J. Carter of Charitorn; "The Adjustment of Railroad Rates," by Prof. G. C. Pratt, State Railroad Commissioner; "Magnetic Declination at Different Points in Missouri," by J. Y. Powell of Chillicothe; "Sanitary Engineering,—How shall we prepare for the Cholera?" by Prof. Paul Schweitzer of Columbia; "Relative Resistances of Different of Bridge Piers," by Prof. J. Ficklin of Columbia; "Mine Surveying," by Prof. J. W. Spencer of Columbia; on most of which there was considerable discussion.

The following officers for 1885-1886 were elected:

President, Prof. G. C. Pratt, Railroad Commissioner of Mo.; 1st *Vice-President*, G. W. Latimer, of Marshall, Mo.; 2nd *Vice-President*, S. J. Carter of Keytesville, Mo.; 3rd *Vice-President*, B. D. Weedin of Lexington, Mo.; *Secretary*, Prof. T. J. Lowry, of Missouri University; *Treasurer*, W. E. Wright, Columbia, Mo.

After passing several votes of thanks the meeting adjourned. The convention was double the size of any held heretofore. The next meeting will be held in the engineering rooms of the Missouri University, beginning on the first Thursday in June, 1886.

TRACK.*

BY W. B. PARSONS, JR., C. E.
ROADMASTER SUSQUEHANNA DIVISION ERIE R. R.

(*Continued from page 380*).

The wire fence is of recent origin and may be still considered as in its infancy, for there is still a strong predjudice against it, forcing many of the States to take action as to its legality. In some it is illegal, in some legal, while in others it is only lawful for highways and not for division fence without the consent of both parties.

There are many styles of wire differing widely and there is no recognized standard for building a fence of this character.

Some parties have the posts the same distance apart as in a board fence. Others 10, 12, 16, 20, 24 or even 30 feet apart according to their views. Possibly the most common practice of to-day is to have the posts 16 feet apart which should certainly be the maximum limit, for if greater than this the fence becomes weak. In favor of 16 feet there is one strong argument, i. e., should at any time the State declare wire fence to be unlawful, or for other cause it is desired to return to a wooden fence by simply adding the alternate posts it becomes ready for the boards. In order to stiffen the wires, when the posts are set 16 feet or more apart, there are several patent devices of rods interlacing the wires midway between the posts, or there may be used, to gain the same effect, a strip of wood about 1 inch × 2½ inches held to each wire by a staple. Better however than 16 feet is 12 feet, like Fig. 94, at which distance the fence is perfectly stiff and strong. In putting on the wire the strand is attached to the first post, and then pulled taut when it is secured to

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all the other posts by staples. If the ground is not sufficiently strong to hold the posts stiff, to resist the strain of stretching the wire when putting it up, there should occasionally, about every twentieth panel, be a straining post braced like the center post in the diagram, but all corner posts and the original starting post should be held in this manner.

Wire fence is made with 3, 4, or 5 strands according to the cattle against which it is used. But 4 strands should be the minimum number, and 5 preferred, especially if sheep and hogs are liable to be enclosed.

One of the objections against wire fence is that cattle cannot see it before they run hard against it. To meet this objection a strip of wood, about 2 × 4 laid flatways, is nailed on top of the posts. Fig. 94 shows two styles of wire fence, one with the wooden strip and four strands of wire, the other with five strands. The existing prejudices against wire fence is based on the injury the barbs do the cattle, and its indistinctness permitting animals to run hard against, and sometimes to get entangled so as to receive severe injury. On the other hand it makes a fence less in prime cost, more permanent and durable, one which fire and wind will not hurt, which will not cause snowdrifts in winter and the expense of repairs of which is small. In selecting a wire, judgment should be exercised to choose one which is strong and elastic, so as not to suffer from contraction and expansion, one which is distinctly visible, and whose barbs cannot inflict injury. Although like many other innovations it meets with partial disapproval from the outset, yet, undoubtedly, a metal fence of some description is the fence of the future.

The subjoined table gives bills of material for one mile of post and board fence, like Fig. 93, and for the same distance of 5 strand wire fence, with posts 12 feet centers, like Fig. 94, and also the amount of labor in each case required for erection. With present prices the cost of the wood fence is greater in the proportion of 4 to 3, but by putting the posts 16 feet centers, with 4 strands of wire as is usually done, the cost of the metallic fence is proportionately decreased.

POST AND BOARD FENCE—ONE MILE.

660 posts; 1,320 boards, 6″ × 1″ × 16′ = 10,560 feet B. M.; 660 battens, 6″ × 1″ × 4′ = 1,320 feet B. M.; 250 lbs. nails; 65 days labor.

WIRE FENCE—ONE MILE.

440 posts; 26,400 feet wire—about 440 lbs. per strand = 2,200 lbs; 75 lbs staples; 27 days labor.

(TO BE CONTINUED.)

CORRESPONDENCE.

"Samel" Bricks.

ALLEGHENY, Pa., June 15, 1885.

EDITOR ENGINEERING NEWS: *Rees' Cyclopædia*, 1st American edition, describing the burning of brick, says: "This operation is much better performed in kilns than in clamps, as the fire can be kept up and regulated at discretion: while in clamps, as the whole fuel must be put in at once, the manufacturer is always tempted to use too little, and the outside bricks are necessarily under-burnt. These are called "Samel bricks" and are sold at an inferior price." *Halliwell's Dictionary of Archaic and Provincial Words*, etc., gives: "SAMEL.—gritty; sandy." I. C.

Fly-wheel vs: Duplex Pumping Engines.

TOLEDO, JUNE 11, 1885.

EDITOR ENGINEERING NEWS: In your issue of May 30th, I notice the publication of a paper, read by Frank H. Pond, Esq., of St. Louis, before the Engineers Club of that city. The paper contains some interesting statistics concerning water-works, and also some remarks which very clearly illustrate the old proverb that, "a little knowledge is a dangerous thing."

I do not for a moment of course, mean to intimate that the author of said paper is possessed of "little knowledge;" but rather that he has so adjusted a very little knowledge before the public mind, that the logical deductions from the paper, reflect very unfairly and unjustly upon a particular make of crank and fly-wheel high duty engine.

I cannot withhold my admiration for the tact, and ingenuity with which Mr. Pond has manipulated facts and figures to serve his purpose in holding up the non-rotative duplex type of pumping engine, against its formidable high duty opponent; to say nothing of the skillful use of the shears by which he has incorporated bodily, several important paragraphs from an article written by myself about three months ago, and which appeared in the *Millwright* and *Engineer* published in Milwaukee, Wisconsin.

Taking the paper in the order of its details, I will first remark that the particular high duty engine he undertakes to show up at a disadvantage in his tables, is so designed and constructed that practically it is about as "direct" in its action and effects, upon the water column, as the non-rotative duplex engine in general, and the one represented by Mr. Pond in particular; and it does not depend exclusively upon the momentum of fly-wheels to finish its stroke. As to the "expensive and massive foundations to absorb the shocks and jars incident to their working," it would puzzle the entire Engineers Club of St. Louis to discover the "jars and shocks" of the above mentioned high duty engine. The foundations are no more than necessary to support the weight of machinery, the working strains being self contained within the engine; the conditions under which this crank and fly-wheel engine is working, bars out completely any and all non-rotative machines with which it is compared.

Mr. Pond brings a direct issue between non-rotative duplex engines, and the high duty engine already referred to, in the tables he presents with his paper; but he does so in a very "cute" manner well calculated to mislead not only the general reader, but also well informed engineers. This misrepresentation consists simply, in deliberately comparing a long stroke easy working crank engine, with a short stroke hard working duplex engine; and by so doing reducing the interest account on the duplex and barely making a showing in favor of the duplex in yearly expense. In the comparison of ten million engines, wherein the strokes of both types are the same, he fails utterly to carry out the results, so as to show the annual cost of owning each, including repairs and interest. If he had carried it out, or rather if he had put the results in his paper which he is well aware, he and his hearers would have realized that the crank engine would come out nearly $2,000 cheapest per annum, with coal at the extremely low figure of $2.00 per ton.

He has assumed that 2 per cent. per annum is necessary for repairs of the crank engine referred to; this is too high, and the figure he sets for the duplex is entirely too low, for the simple reason that the duplex engines he refers to, and from which he estimates his yearly repair account, have been allowed to run for a long time without repairs that were badly needed, so that when these engines are put in first-class condition there will be practically no material difference in repair bills between the two types considered. To show how Mr. Pond has strained a point to fix up his tables, I will state that the $20,425 he takes for the cost of the duplex engine, is taken from a bid and not from an engine in use, while the item of repairs is taken from a duplex of one-third longer stroke for the same amount of pumpage per day, and even this long stroke engine has extensive repairs long past due but which have not been made.

Leaving repairs out of the question then, and comparing the five million crank engine of 4 ft. stroke with the duplex of 4 ft. stroke instead of 3 ft. stroke, the cost of the 4 ft. duplex will be $275.00, instead of $204.25, and this will make the crank engine about $1,000 cheapest with coal at $2 per ton.

A little cool reflection will I am satisfied, convince even Mr. Pond that the vague pointless remark, "any important part of a crank and fly-wheel engine is expensive to replace, while in the duplex engine there is no single part which could cost over $50 to replace," might well be "replaced" by something a little more sensible and nearer to the facts.

Finally, the statement that a crank and fly-wheel engine necessarily requires more constant care of the attendent, than a duplex engine is without foundation; and instances may be found all over the country, wherein the same number and class of attendants are employed with both types of engine, each seemingly having about the same duties to perform. As a matter of fact it requires more skill and attention to keep the non-rotative engine up to its *full length of stroke*, than is required for anything connected with a crank engine. The best men necessary for the work required should be employed to care for any machinery, but the quality and number required for a non-rotative engine of any certain capacity, are abundantly able to take charge of the best high duty crank and fly-wheel engines of like capacity; and if there is any difference the chances are most decidedly against the non-rotative type.

In conclusion I will quote from Mr. Pond but will most cheerfully give him credit, (provided it is his own).

"In concluding, I trust I have brought out a few points which may be of interest to you on the subject of pumping machinery for Water-works, and hope you will see the importance of taking *all the facts* into consideration. * * * * If the total saving in current expenses shows on the right side to the ledger, a high duty pumping engine is a good investment, otherwise it is not." Very respectfully,

CHAS. A. HAGUE.

[While we regret the personality of Mr. Hague's letter, we believe it to be our province to give both parties to a controversy an opportunity to express their opinions. When publishing Mr Pond's paper we were not aware that an attack was intended on any particular make of engine, as Mr. Hague apparently intimates; and still hope that such was not the case. But having republished the one, justice demands that we give Mr. Hague a hearing; but without assuming any responsibility for either. ED. ENG. NEWS.]

WATER.

THE work of laying the water-pipe of Belleville, Ill. was commenced June 1st.

HARRISONBURG, Va. will spend $25,000 in water-works, according to a decision last month by popular vote.

THREE hundred men will be put to work on the new water-works for Rockland, Me.

THE Pioneer canal on the Laramie plains, Wyoming has at last been completed.

THE Sioux City, Ia., reservoir will be completed in two months. Its capacity will be 1,500,000 gallons.

THE Northwestern Railway company is sinking an artesian well at Storey City, Ia., for tank use.

HELENA'S (Mon.) new water company has a reservoir with a capacity of 100,000 barrels. It cost $25,000 to construct it.

CARROLL E. GRAY, Jr., has closed a contract with Fairbanks, Morse & Co., to put in the distribution system at Beloit, Wis.

THE Eau Claire, Wis., water-works company is making remarkably rapid progress in pipelaying, and on June 6th, increased the force to two hundred men.

JAMES M. MOORE, U. S. A. will receive bids until June 25, at Fort Snelling, Minn., for pipe, pumps, tanks timber, etc., required for the water supply at Forts Buford Totten and Pembina, D. T.

A TUNNEL is being run into the side of Lookout Mt. to tap a subterranean water supply now known to be there. It has progressed 125 feet; about 500 feet will be the furnished length.

A MEETING of citizens was held at Menominee Wis., to discuss the plan of putting in water-works for the city at a cost of $3,700 a year, which amount would be saved on insurance alone. A committee was appointed to look the matter up.

THE County Board of Health of Birmingham, Ala., have issued an order requiring the Elyton Water Works to obtain their water supply some distance from the present point of supply, as it is supposed the water now furnished is contaminated.

THE new machinery of the Rome, N. Y. Water-works is in place and accepted by the commissioners. The new pumps have a capacity of 5,000,000 gallons in 24 hours and were made by B. S. Nichol & Co., of Burlington, Vt., for $5,800.

THE Pond Engineering Co., St. Louis, have been awarded the contract for the pumping machinery complete for the Mason City, Iowa Water-Works, which will consist of two Blake duplex pumping engines having a combined capacity of 1,500,000 gallons per day, with boilers, heater, feed pump, etc, all erected in complete working order.

ON June 10th, the people of Orwigsburg, Pa., voted on the question of the introduction of water to the borough. The Orwigsburg Shoe Company have been supplying water to a few people for some time past when the supply was abundant; but when scarce they have had the privilege of turning it off.

ROCKLAND, Mass, on June 12, accepted the act of the Legislature giving the town authority to introduce water from the Pembroke ponds. Water commissions were elected and they are to consult with the town authorities as to the best method of raising money for the work.

ARLINGTON, Mass. At an adjourned town meeting on June 12th, it was voted to issue water-bonds to the amount of $100,000, to bear one per cent. interest the first four years, 2 per cent. the fifth and sixth, 3 per cent. the seventh, eighth, ninth and tenth, and 4 from the eleventh to the thirtieth years.

W. YATES, engineer of the London, Ont., Water-Works, recommends that an additional boiler be secured, the engines strengthened, and the stays rearranged. Messrs. Stevens, Turner & Burns, of Toronto, secured the contract for iron pipe at 50 cents a foot for laying and all, and $34 a ton delivered.

In all probability Decatur, Ga., will soon have a full-fledged system of water-works. It is proposed to erect a couple of reservoirs, each with a capacity of 10,000 gallons, to be filled from wells by means of windmills. The matter is in the hands of men who will push it for all it is worth, and from the reception that the business men have given to the plan, it seems that it will be accomplished.

THERE is a leak in the St. Anthony Falls water power at Minneapolis, Minn. The waste is estimated at 40,000 gallons per minute, from an unknown source. The opinion is expressed that a new sewer above the falls is responsible for the damage.

COMMISSIONER SQUIRE has rejected all bids received up to June 9, for three contracts for laying water-pipes in the annexed district. On two of the contracts the price named for rock and earth excavation, earth filling and brick masonry was 1 cent per cubic yard, making the total amount on these four classes of work less than 2 per cent. of the whole bid. Commissioner Squire says that the four items on a fair apportionment should represent 60 per cent. of the bid.

GADSDEN, TENN., has secured as fine a system of water-works as can be found south. The contracting parties are Col H. C. Comegys, J. Ensign Fuller and associates of New York City. The company furnish one million gallons per day, obtained from the Coosa River and pumped into a reservior giving a head of 150 feet and pressure of 65 pounds to the square inch. The city have taken such a number of fire hydrants as will give adequate fire protection.

C. E. A. JACOBSON, Engineer of the Newark, N. J. Aqueduct Board, has been ordered to prepare at once plans and specifications for an additional 5,000,000 gallon pumping engine and the laying of 9,000 feet of 20 inch pipe. This is in accordance with the report of consulting engineer J. J. R. Croes, presented June 3, showing the impracticability of transferring a portion of the high service district to the low service, and thus utilizing the present high service pumps for some time to come.

ASPEN, Colorado, June 9.—An enthusiastic meeting, called by Mayor Reese, was held last night, to consider the subject of Water-works. The only question was whether the city should build its own works or give the franchise to a private corporation. The discussion was one-sided, and a motion was passed that it is the wish of the people that the city issue bonds for the construction of Water-works.

The probable cost will be $40,000. The water will be taken from the pure cold mountain stream of Hunter's Creek, which will furnish a head 300 feet above town. The result of the vote on an ordinance will be anxiously awaited by the insurance companies, who at the meeting, through an agent, threatened to withdraw from the camp unless immediate and decisive action was taken to provide better means for extinguishing fires, though they now get 10 per cent on risks.

LOWELL, Mass, June 12.—The analysis of the Merrimac river water, used in Lowell, by Professor Cabot of Boston, shows that the liquid is not deleterious. It is free from sediment and contains nothing more hurtful than iron. Superintendent Holden is making preparations for cleaning out the conduit, on the bottom of which there is three inches of ferrous silt. A 36-inch gate will be fitted to the lower end of the conduit at Beaver brook, and by that means a thorough cleaning out under a full head of river pressure will be assured. The reservoir also will be cleaned this summer. It has a deposit of silt two feet deep in some places, but otherwise it is in good condition. While it is being cleaned the gate house chamber, built for such emergencies will be used. It is 20 feet square and 25 feet deep, and takes the place of a stand-pipe.

A PLAN has been adopted in the town of Shrewsbury, England, for the utilization of sewage, the success of which is said to be perfect. As the sewage enters the works, clay, charcoal and blood are added as deodorizers, and, after thorough mixing, a solution of sulphate of alumina is added, by which the dissolved and suspended impurities are quickly precipitated in one or the other of the settling tanks, from the fourth of which the water runs without further treatment into the river. The sewage as it enters the works contains about 37 per cent. of suspended organic and inorganic matter, but in the affluent water there are found only the merest traces of either. By experiment it has been found that in this water fish will live for months. The deposit is then removed from the tank, and, by means of pressure and artificial heat, is derived of its moisture, till it contains the consistency and appearance of dry earth, in which condition it meets a ready sale as "guano."

ASKING IMPROVEMENTS OF THE CANAL.—A movement was started a few weeks ago to organize a canal union for the purpose of advocating and securing improvements deemed to be necessary in the Erie Canal and its lateral branches. Canal men believe that the transportation facilities of the canal can be much increased by deepening and in some places widening the channel and enlarging the locks. The estimated cost of the proposed improvements is $3,000,000. When the first circular broaching this subject was issued it was stated that as soon as 100 names had been obtained in favor of organization a preliminary meeting would be called. More than 100 names have been obtained thus far, and a meeting will soon be called for some day early in July. Included among those persons who favor the proposed union are ex-Gov. Horatio Seymour, Senator Warner Miller, State Senator Arkell, and many other men prominent in public life. Many of the signers are from the interior of the State.

THE Finance Committee of Philadelphia Councils on June 11 resolved to favorably report bills to appropriate $1806.65 for the refunding of twice-paid water rents and water rents paid in error, and to appropriate from the balance to the credit of Gas Loan No. 9, $300,000 to complete two sections of the East Park Reservoir, $350,000 for land damages and work at the proposed Cambria Reservoir, $150,000 for replacing old rotten mains with new and $50,000 for work on the new county prison.

THE water-works Trustees of Lima, Ohio, will receive bids until noon of June, 23rd, for excavating about 80,000 cubic yards of earth and forming embankments for reservoirs etc. Also furnishing all material except pipe and castings for the construction of all drains, waste weirs, gate, wells etc., also hauling and laying 5,000 feet of 30-inch influent pipe, also the building of pumping house, etc., with smoke stack 100 feet high.

NEWS OF THE WEEK.

Contracting.

The Windsor Locks, Conn., Suspension Bridge, over the Connecticut River, 1100 feet long, has been awarded to J. W. Shipman, engineer and contractor, 89 Tribune Building, N. Y. Price, $55,000.

The Southwestern Lunatic Asylum, to be erected at Marion, Va., will cost $100,000. The general contract has been awarded to McDonald Brothers, of Louisville, Ky.

Dallas, Tex., Northwestern Railway.—Fred Harris the engineer who built the Texas Central Railway from Groosbeck to Dallas, will begin a survey of this line to the Northwest at once, and as soon as a definite line is determined upon the road will be built.

Brick and Stone Work.—Chadbourne & Locke, masons, have been awarded the contract for the brick and stone work of the new Arlington mills at Lawrence, Mass. It is estimated that 1,000,000 bricks will be required for the building.

The Minneapolis Sewer Tunnel.—The *Pioneer Press* says, that as a result of the inspection of June 8, work is to be stopped on the sewer tunnel now under contract in North Minneapolis. The estimated length of the tunnel is 7,000 feet, of this about 1,372 has been driven. The cause of the trouble is not clear from the press accounts, and the city authorities seem reticent. It appears that the rock is not as solid as is desirable and there are some fear of the breaking in of water from the river and lakes in such volume as to destroy even the substantial masonry now in place and being put in.

The Robert Street Bridge, St. Paul, Minn.—The city engineer has received the plans and specifications for the Robert street bridge, and bids for the construction will be accepted until July 6. It will be 53.5 feet in the clear between the railings on the deck spans, so as to give a roadway of 32 feet and two sidewalks, each 10 feet wide. Bids will be received separately for the 352-foot span—the longest of them all. The carrying weights of all the spans are determined and specified in the plans. The flooring is to be prepared for the reception of cedar block paving. The bridge must be finished and opened for traffic within ninety days after Dec. 1, and each day after March 1, 1886, that the work remains uncompleted a $100 penalty will have to be paid

Railroads, Bridges and Canals.

Wisconsin, Pittsville and Superior R. R.—Survey commenced. Length of line 17 miles.

R. R. Bridge at Logansport, Mo.—The Union Bridge Company have the contract for the superstructure; Medland & Barnes, for the substructure.

Ottawa, St. Lawrence & Schenectady.—The construction of this proposed road from Ottawa to Schenectady as a connection of the Canadian Pacific, was to begin on the 12th inst.

The St. Louis and Kansas City Short Line Railway.—This contemplated road is to run between St. Louis and Kansas City, and will be 250 miles long which shortens the distance 37 miles. Its capital stock is to be $5,000,000.

The Fayetteville and Hocking Valley R. R. contemplates building their line into Cincinnati. Rights of way have been obtained between Fayetteville and Hillsboro, and the receiver has been authorized by court to issue bonds which will, with the subscriptions and donations, be ample to complete the road thus far eastward.

Yazoo and Miss. Valley R. R.—The Directory of the Illinois Central Railway Company have ordered the extension of the Yazoo and Mississippi Valley Railway northward from Yazoo City to the crossing of the Yallobusha River, a distance of 70 miles, at an estimated cost of $15,000 per mile. This will open up the magnificient Yazoo delta to the railroad world.

Bridge Contract—The Aransas Pass Railway Directory have let the contract to furnish all the trestlework and piling to the Hopkins Bridge Company, of St. Louis.

The Dubuque & Northwestern R. R.—Has contracted with the Minnesota Loan and Debenture company for the construction of a line of road from Dubuque to a junction with the Minnesota and Northwestern. This will be the line over which the Burlington, as well as the Illinois Central, will gain an entrance to St. Paul. The Burlington will build on its own hook from Clinton to Dubuque.

The Minnesota & Northwestern has begun work upon the draw span of its bridge across the Mississippi at St. Paul. The draw will be 412 feet in length, and will be among the very longest in the world. A portion of it has already arrived in St. Paul and the remainder is expected within the next few days. It was manufactured at Paterson, N. J. The draw when completed will be worked by a double cylinder Westinghouse engine.

A. T. & Santa Fe R. R.—Indications now are that the Sonoar division of the Atchison, Topeka, & Santa Fe road is to become a self sustaining property. In 1883 this road earned $93,495 less than its operating expenses; in 1884 it was still $33,123 behind; whereas for the first four months of this year the earnings are $24,844 more than operating expenses. The Sonora can hardly escape a gain of $100,000 over the net results of last year.

The Bureau and Northeastern Railroad.—The proposed route is from a point in the county of Bureau, Ill., through the counties of Bureau, La Salle, Lee, Ogle, De Kalb, Boone, and McHenry. The principal office is to be in Chicago. The capital stock is $3,500,000 and the incorporators and first Board of Directors are Herman Dickersham, Arthur H. Chetlain, Leonard M. Hodges, Henry Stebbins, and Edward F. Guerdon, all of Chicago.

A New Line.—LOUISVILLE, COL., June 9th.—A corps of surveyors are working near here on the old Denver, Western & Pacific grade which was recently purchased by the Union Pacific Company. The work of track laying will be commenced right away. The old grade will be used with perhaps a few alterations. The old Colorado Central track will be abandoned when the new road bed is completed. This grade is undoubtedly the best in the State, excepting, of course, the main lines of the road.

Georgia Pacific R. R. Extension.—The Georgia Pacific R. R. (narrow gauge) has under consideration the construction of a line from Johnsonville, the terminus of their road, to Lexington, which is the terminus of a branch of the Illinois Central R. R. The distance is forty miles, and Captain Sage, the superintendent of the G. P. R. R., thinks the line will pay, either as a total extension of the narrow gauge, or as a link in a through line to Atlanta.

Chicago St. Louis & Nashville R. R.—The construction of the road will be commenced within the next fourteen days. It will run from Nashville, Tenn., via Paducah, Ky., Metropolis and Carbondale, Ill., to East St. Louis. The construction of the road is a fixed fact. Its length will be 289 miles. It will be standard gauge. The road will run through a rich country and be of great advantage to St. Louis.—*Nashville American.*

The Callowhill St. Bridge.—The western end of the Callowhill St. Bridge over the river Schuylkill, in Philadelphia, is reported to be in a very bad condition. The location of the trusses over the Penna. R. R. tracks on a sharp grade has brought about a sliding on the piers, and the iron in the girders, possibly effected by the continual smoke from the engines, is peeling off in flakes one-quarter to three-eigth inch thick. The pier masonry is said to be badly cracked and temporary shores are now put under the girders.

Leroy and Caney Valley Air Line Railroad.—Incorporated to construct a railroad and telegraph line from Leroy, Kansas, to the Caney Valley, on the south line of the State of Kansas, in Chatauqua County, running through the counties of Coffey, Woodson, Wilson, Montgomery and Chattaqua, a distance of eighty miles. The headquarters of the road are to be at Fredonia, and the capital stock is placed at $1,000,000. The Directors are L. C. Wait, Elgin; J. F. Clark and Frank Crouse, Sedan; M. D. Wright and F. E. Traver, Elk City; T. W. Strong, Talleyrand; J. W. Allen and G. S. Clark, Fredonia; J. L. Sexton, Prairie, and Harry Brown, Cliffin.

Canadian Railrailroad Subsidies.—In the house of commons on the 11th Sir John A. MacDonald gave notice of the resolution granting aid to the following railways:

For a railway from River des Lord, on the Intercolonial, to Edmondton, N. B. a subsidy of $6,600 per mile for twenty-five miles, or a sum whose total does not exceed $198,000.

For a railway connecting the harbors of St. John and Halifax, via Moosehead lake and Metawankeag lake, a subsidy of $240,000 per annum for twenty years, or a guarantee of a like sum as the interest on the bonds of the company undertaking the work.

The Deadwood and Redwater R. R.—The new road will be a narrow gauge, fifty miles in length, and will cost about $500,000.

Nashville & Knoxville R. R.—Rights of way are being rapidly secured by Maj. Negley, of Pittsburg, for the Nashville and Knoxville Railroad, and work will soon begin on the line. The road commences on the south bank of the Cumberland River, opposite Carthage, passes up the west side of that stream along its valley fifteen miles to the mouth of Indian Creek, where it crosses. Thence up Buffalo Valley to Cookeville on the Highland rim, and to Standing Stone on the mountain, intersecting the Cincinnati Southern in Morgan County.

Arkansas and Grand Prairie R. R.—It begins at Stuttgart, in Arkansas county, on the Paramore road, and runs by Arkansas Post, thence to Breene, Lonoke county, on the Iron Mountain roads. Its full length is seventy-five miles, and it will open up the richest prairie land of the State. By an act of the Legislature, work must begin on the road within two years, and ten miles must be completed each year thereafter, or the charter will be forfeited. The capital stock is $500,000. J. A. Crawley, Frank Weeks, D. F. Keeney, G. E. Calkins and D. C. Smith, of Chicago, take $25,000 each.

R. R. Extension.—The Glenwood (Col.) *Echo* asserts that it is rumored there that the Chicago, Burlington & Quincy will commence construction work within thirty days. By building through the canon and connecting with the Rio Grande Western, the distance to the Pacific will be shortened 70 miles over the Union Pacific and 100 over the Southern Pacific—quite an object to travelers or a speedy through mail service. This information is not official, but from the company controlling the canon, their numerous surveys, and the confidential talk flying around, it is numbered among the possibilities.

Blackwell's Island Bridge.—Dr. Thos. Rainey, of Ravenwood, whose bill extending the charter for bridging the East River at Blackwell's Island passed the Legislature of this State at the last session, says they propose to build a steel cantilever. The total length of ironwork will be 9210 feet. The span from New York to Blackwell's Island is 734 feet, and the span over the east channel is 618 feet. The spans will be 150 feet above mean high tide. There will be a double railway, double carriage tracks and double promenades the entire length of the bridge. To raise the money it is intended to issue 6 per cent. bonds to the amount of $3,000,000, and stock to the same amount. It will probably cost less than $5,000,000 to build the bridge and buy the right of way, as well as provide a depot in New York City.

Interesting to Engineers.—A railway survey is being carried on through the North Cachar hills in Assam, and among other difficulties it encounters, is the number of man-eating tigers which infest the district. A few weeks ago Mr. Lodder, the engineer, was setting out through the jungle to work in the early morning with a party of nine men, when a tiger suddenly sprang forward, seized one of the Goorkhas by the throat, and was off in an instant. Mr. Lodder, armed only with a hatchet, at once gave chase; three of his men joined him, and following along the trail, partly marked by blood and bits of the man's clothes, they ran the beast so close that after a mile and a half he was compelled to drop his victim. What was left of the dead body was tied to a bamboo, and the little party pushed back with their burden.

New Lines in Arizona.—The Calbasas, Tucson and Northwestern contemplates, in addition to the construction of 350 miles of railroad to the most important mining and agricultural points in the Territory, the creating of an artificial water supply by sinking deep wells, pumping the water to a pipe line in the road-bed, for the use of stock in desert places, under patents of the Combined Railway and Cattle Water Supply, and the placing of cattle along the line of the road. This branch of the enterprise is in the hands of a corporation known as the Arizona Cattle and Improvement Company, composed of prominent Eastern men, among whom are Thomas L. James and William Windom. The company also purpose erecting the largest reduction-works in the West, at some convenient point on the line, and will transport and reduce all classes of ores at the lowest possible rate. A contract has been let to an English syndicate to build and equip and stock the road, subject to the granting of county subsidies.

Miscellaneous.

A 147-ton Crane.—A crane capable of lifting a weight of 147 tons is in course of construction at Hamburg. It will be the largest machine of the kind on the continent of Europe, that of Antwerp coming next with a lifting power of 129 tons.

Barbed Wire as a Means of Military Defense is a new appliance. In Cartagena the rebels were about to attack the ramparts with scaling ladders, but becoming entangled in some lines of barbed wire stretched along the beach where they landed, were held in check until the artillery made fearful havoc in their ranks.

A Russian Pullman City.—One of the latest experiments in the organization of industry comes from Russia, where the employees of the large engineering works belonging to the firm of Struve & Co. have recently been planted in a complete settlement somewhat like Pullman City, near Chicago. The workmen, of whom there are between 3,500 and 4,000, are all lodged in small cottages, most of which are made to accommodate two families only, while the public institutions of the colony include a refectory, a laundry, a hospital, a benefit society, a technical school and a co-operative store. The employers contribute handsomely to the benefit society, but charity in any other form is quite unknown in the place, and the co-operative society pays a flourishing dividend.

Baku Petroleum.—The official returns of petroleum, etc., exportation from Baku to the rest of Russia and abroad in 1884, as compared with 1883, have just been published in the Moscow *Golos*. Reckoning the pood at five gallons, the production of the Russian oil fields at Baku was equivalent, in 1883, to 145,179,705 gallons, or 3,456,659 barrels, 42 gallons each. In 1884, to 268,422,485 gallons or 6,391,011 barrels or 42 gallons each. This shows an increase of 2,934,352 barrels. Included in this is the residuum, naptha, lubricating oil, benzine and asphaltum, leaving only 21,721,971 poods or 108,609,855 gallons of refined petroleum. Of the refined petroleum shipped 17,572,641 poods went by sea via Astrachan to Russia alone. This shows a notable increase, yet nearly all the refined petroleum is consumed in Russia, very little of it in Western Europe, where it is estimated that over 20,000 barrels actually went into consumption last year. It is different from lubricating oil, which evidently has a great future as an article of export to Western and Central Europe, although even in this item American competition is rather on the increase than otherwise.

A New Railroad Signal.—The officials of the Missouri Pacific Railroad made some experiments at the Big Bend road, near Benton Station, to test a new railroad signal invented by Mr. H. H. Liemke, of this city. The signal is intended to give notice of the approach of a train at crossings, and thus prevent accidents and damage suits. It works partly automatically, and partly by electricity. The wheels of the train passing over the track press down a rubber-ball fixed on the inside of the track. The air is pressed from the ball through a tube leading to another little ball affixed to a telegraph pole. This second little ball becoming inflated raises a kind of a lever which connects a circuit on a telegraph wire which connects this arrangement with the signal going several hundred yards away. As soon as this lever is pressed up the gong begins to ring and rings for two or three minutes, thus warning all who pass along the road of the approaching train. It is a valuable arrangement in places where the wagon road crosses a track inclosed by hills, preventing any one seeing the train.

The Alaska Boundary Line.—OTTAWA, June 9.—The attention of the Dominion Government has been called to a serious difficulty which may at any time arise between the United States and the Dominion Governments, through the delay in definitely fixing the international boundary line between Alaska and British Columbia. The discovery of gold in the Yukon district, and on Iunac River, is attracting large numbers of miners into that part of the country. It is now reported that those who have taken up claims are unable to define whether they have located on United States or British territory for want of a fixed boundary line. It is also represented that the boundary line where it crosses Stickeen River is only imaginary, and the enforcement of customs laws at this point has become difficult. Representatives from British Columbia are pressing the Government to have a survey made at once in conjunction with the United States authorities whose co-operation they believed would be easily secured. It is estimated by the Government engineers that it would cost from $4,000,000 to $5,000,000 to lay out a correct boundary line.

A Powerful English Ironclad.—The twin screw, armor-belted ram Benbow was launched from the slip of the Thames Iron Works and Shipbuilding Company on June 15th. The Benbow is by far the most powerful ironclad afloat; over 10,000 tons of metal have been used in her construction. She is built entirely of steel. Even her armor-plates, which are 18 inches thick, have a facing of six inches of chilled steel, and many of them are of the weight of ten tons.

The Benbow is 330 feet long, 68 feet 6 inches beam, 27 feet deep, and has a displacement of 10,000 tons. Her engines are 9,500 horse power, and will, it is estimated, give her a speed of 17½ knots per hour, making her not only the most powerful but the fastest armor-clad afloat. Her armament is to consist of two 110-ton steel guns, which will fire a projectile weighing 2,000 pounds, 16¼ inches in diameter, and propelled by the enormous charge of 900 pounds of powder. She will also have ten 6-inch rifled breech-loading guns, twelve six-pounder quick firing guns, ten 4 barrel 1-inch machine guns, and four 5 barrel 45-inch machine guns. She is also fitted for torpedoes, having five apertures for their discharge.

Mining by Electricity.—Experiments are being made at Streator, Ill., in the application of electricity as a motor in operating coal cutting machinery. The first trials have been very successful.

An Early Panama Canal.—A German authority states that a curious historical document concerning a Panama canal exists in the archives of Venezuela, bearing the date of 1780. A canal project, this document records, was broached in the reign of Philip II., but Flemish engineers surveyed the territory and declared that the obstacles to the undertaking were insurmountable. Native Governors, continues this record, thereupon pointed out to the King the enormous commercial disadvantages likely to arise in Spain from such an undertaking, in consequence whereof Philip II. issued a rescript which threatened with death any person alluding, by word or writing, to the project.

Telegraphy in the U. S.—The United States has more than three times as many telegraph lines, double the number of telegraph offices and forwards twice as many telegrams annually as any other country on the globe. The figures for the United States are: Length of line, 163,940 miles; number of offices, 14,402; messages sent last year, 57,942,247. Russia comes next in miles of line, with 53,736, but is far behind in number of offices and telegrams sent. France, Germany, Austria and Australia rank ahead of Great Britain in miles of line, having 45,878, 45,070, 31,121 and 21,831 miles respectively, though Great Britain with 31,345,861 telegrams forwarded, sends a few more than one half the number sent last year in the United States. In number of offices in Europe, Germany, with 7,366, has the most and Bulgaria, with 37, the least.

A New Mail Route to Cuba. WASHINGTON, June 8.—Superintendent Bell, of the foreign mail service, and Second Assistant Postmaster General Knott will very soon advertise for a mail service over a new route between the United States and Cuba. At present the route of this service is by way of New York and thence to Cuba by water. This ocean trip requires four days or more. The new route contemplated is by rail and water. It will consist of 1260 miles of rail and 90 miles of water, and will be from New York to Tampa, Fla. by rail, thence by ocean.

Bids for proposals for contracts will be advertised for shortly. Bids would be called for at once, except that a railroad under construction in Florida, which is to form part of the way, is not quite finished. The new service will go into operation some time in August.

The Lick Observatory.—During the year 1884 noticeable progress was made in the construction of the Lick observatory, California. The meridian circle building, a handsome structure, with double walls of wood and iron, and resting upon a foundation of masonry, has been completed. It contains a fine meridian circle instrument, solidly mounted upon brick piers, with rock foundations. Several other buildings have also been finished, including the observer's house, built of brick and three stories high, a commodious double dwelling for the accommodation of astronomers and pupils, and the observatory library, which is already supplied with a number of valuable scientific works, and is in receipt of astronomical exchanges from abroad. The observations during the transits of Mercury and Venus have already furnished satisfactory proof of what may be done at the observatory, and also those taken during the eclipse of the sun of March 16, 1885. On the 22d inst. a telegram was received stating that a crown glass disk for the 36-inch objective had been successfully cast by M. Feil, in Paris, which it is hoped will prove without a flaw. It is now being polished to settle this point.

Germany's New Corvette.—An addition to the German Navy was made on May 18, by the launch, at Dantzic, of the fast cruiser corvette Arcona, which took place in the presence of Gen. Von Caprivi (the chief of the German Admirality), General Jachmann naming the vessel. The Arcona is a sister ship to the Alexandrine, launched in February last at Kiel, and is of the following dimensions: Length between perpendiculars, 72 meters, (237 feet;) breadth of beam, 13 meters, (42 feet;) displacement, 2,370 tons. She is built of iron and steel throughout, and has a double planking of teak, sheathed with copper. Her draught of water when completely fitted up and fully armed will be 4.6 meters (somewhat over 15 feet) forward and 5 meters (16 feet 6 inches) aft. The vessel is divided into eight watertight compartments by cross bulkheads, the two largest ones containing the engines and boilers. She will have two compound engines, working independently of each other, placed side by side in the direction of the keel, and developing together 2,400-horse power. Steam will be supplied by eight cylindrical boilers, four to each engine, placed in two separate boiler rooms. The estimated speed of the Arcona is between 14 and 15 knots (16 to 17 miles) an hour. She will be armed with 12 15-centimeter (5.85 inches) and two 8.7-centimeter (3.39 inches) guns, one light gun, and four Hotchkiss guns. She will also be fitted with a launching apparatus for Whitehead torpedoes.

Brooklyn's Dry-Dock.—The famed steamship Alaska, known as "the race-horse of the Atlantic," was safely floated into the large dock in February of this year. This vessel is 540 feet long and is of 6,932 tons

burden; yet when the keel rested on the blocks of the deck floor there were seventy feet to spare inside the caisson gate, and to accomplish this, so effective and adequate to the demand upon them were the various mechanical appliances attached, that it required the services of only ten men to manage and put in place this great vessel. The entire process, from the time the Alaska entered the gate until the water was pumped out of the dock and the steamship dry, occupied but two hours, within which time two large centrifugal steam-pumps had expelled from the dock 5,640,000 gallons of water.—*Brooklyn Eagle.*

New System of Telegraphy.—PHILADELPHIA, June 8.—An exhibition of an entirely new system of telegraphy was given here to-day. The most marvelous thing about the contrivance is, that a single ordinary telegraph wire conveys the electric current and operates the receiving machine. In appearance the sending machine is very much like an ordinary type writer. The instrument has 42 keys, the letters of the alphabet, the numerals, and a few punctuation marks, and every letter or sign struck by the sending apparatus was instantly shown both upon that instrument and the receiver. Pressure upon any key caused a certain number of magnetic impulses to pass through the line. The number of these impulses differ for each letter, and they bring corresponding letters on the type wheel of the receiving instrument into such a position as to mark the impression on a piece of paper. Any person who can read can transmit and receive messages through it. It is as rapid as it is accurate, and all messages by it being automatically printed, both at the point of transmission and that of reception, they can be received in the absence as well as in the presence of the receiver. The recording of messages at both points precludes all questions of errors in transmission. It cannot be read by sound. It is at once a stock indicator, telephone, and type-printing telegraph. The inventor was Mr. George M. Hathaway, but Mr. Linville has done much to make the contrivance practical. The company controlling the system is known as the Hathaway-Linville.

Index to Periodical Literature.

Boiler Trials.—*Condensed, Report of the Committee of the Am. Soc. Mech. Eng. on a Standard Method of Boiler Trials.*—Points out the importance of a system of testing available for general use, with remarks on the units and standards in present use. *Sanitary Engineer*, June 11, 1885, pp. 30, 31.

Drainage.—*Drainage of a Portion of the Fondi Marshes (Italy).* Canals were cut parallel to one another, varying in width from 1.80 metres (6 feet) to 4.50 metres (15 feet), connected by smaller transverse canals. Two steam engines drive two centrifugal pumps, and the water is discharged into a main canal. 12,000 acres have been drained. Illustrations are given of the arrangements of the engine-house and plant. *Le Génie Civil*, May 30, 1885, p. 69.

Earthwork.—*Notes on Earthwork.*—A description of levees and ditches in California, and the implements and methods of construction employed. Notes are also given on the earthwork methods of other countries with remarks on the nature and slope of soils. Tables and a profile are given, and sections of the levees and canals, as well as drawings of the scrapers used. A paper by Geo. J Specht. *Trans. Tech. Soc. of Pacific Coast*, May, 1885, pp. 145 to 170.

Electric Railroad.—A description of the metre gauge line which has been working for 11 months between Frankfort and Offenbach, Germany. Overhead electric conductor supported on posts along curbline, and connected to dynamo on car by slack wires. Average speed 7.2 miles per hour. Driving station midway of route, double horizontal engine 250 H. P., developing 100 H. P. to run 8 cars. *Railroad Gazette*, June 12, 1885, pp. 369, 370.

Iron and Coal.—*The Iron and Coal Regions of Alabama*—Gives a brief history of the discovery and development of these regions, with a geographical description of their location. The extent of the present mines, the nature of the minerals, and the transportation facilities are described. Analysis and a map are given *The Engineer*, June, 5, 1885, pp. 443 to 445.

Metal Ties.—Papers read before the French Society of Civil Engineers. Several systems are described, and the different methods of attachment of the rail are discussed. The cost and durability as compared with wood are also considered. *Le Génie Civil.* May, 30, 1885, pp. 78, 79.

Observatory.—*The New Observatory Dome at Nice.*—A very novel construction. The dome, which has to weighs 95 tons, is 73 feet diameter at and 76 feet 6 inches high; is built of steel ribs covered with steel sheets. It is floated in an lar tank to enable it to be turned easily, the tank containing 41,500 gallons of a strong solution chloride of magnesium, which is denser than water, does not freeze so soon, and will not rust the tank. The history and construction are described in detail. Illustrated. *Le Génie Civil.* May, 30, 1885, pp. 65, 66, 67.

Preserving Timber.—*Rendering Wood for Building Purposes Non-Inflammable.*—A carefully prepared paper on the various preservative processes and applications, with remarks on their efficacy, and notes on fireproof applications for cloth, linen, etc. Read by Mr. Rymer Jones. M. I. C. E., before the Civ. and Mech. Engs. So. (England) in April. *American Architect*, May, 30, 1885, p. 258.

Rivers and Torrents.—*The Treatment of Sediment carrying Mountain Streams in Europe and its Application to California.* A long and exhaustive paper on the question of preventing erosion and waste of debris by mountain streams. The method adopted in the Alpine districts of building timber and masonry walls (thalsperren) across the beds of streams the use of hurdles and facines, and the protection of steep slopes are described in detail; with the results obtained in different instances. The damages caused by these streams are noted, and a resumé is given of the French laws referring to mountain streams; together with notes as to how this information may be used to advantage in California. The paper is fully illustrated with maps, profile and sketches, and drawings of the different classes of works. Geo. J. Specht. *Trans. Tech. Soc. of Pacific Coast*, July, 1884, p 122 to 158.

Sewage.—A paper on the sewage question in California, and relating to one read in May, 1884, by Mr. Hall. Mentions the main principles to be considered in laying out a system of town sewers, and describes in brief different methods of dealing with sewage matter with notes on sewage irrigation and sewage farms. *Trans. of Tech. Soc. of the Pacific Coast.* July, 1824, p 97 to 109.

Splice Bars.—*Breakage of Splice Bars.* Gives a careful description of the nature of the wear and tear at rail-joints, and the consequent effect upon the splices, and suggests improvements. General remarks are made upon the wear of rails and track. *Railroad Gazette*, June 12, 1885, p. 370.

Steamship. Express boats for passenger service on the Seine (France.) They are of steel, 29 meters, (95 ft.) long, and draw about 1.6 metres (5 ft. 3 in.) of water. Speed specified to be 16 kilometers (10 miles) per hour. A full description is given, with illustrations of the construction and arrangements. *Le Génie Civil*, May 23. 1885, pp. 54, 55.

Steel.—*Compression of Liquid Steel.* A full and detailed description of the Whitworth process for forging ingots under hydraulic pressure. The ingot moulds are described and illustrated, and the importance of the system commented upon. *Le Génie Civil*, May 30, 1885, p. 68.

Wheels.—*Bad Wheels and Bad Wheel-Makers.* A careful consideration of the causes of wheels failing, with comparisons between the life and working of good versus bad wheels. Several tables are given of the performances of the different qualities. *Railroad Gazette*, June 5, 1882, p. 361.

Market Report of Engineering Materials.

New York, June 18, 1885.

NOTE.—The following Market Report gives wholesale prices on the New York Market unless otherwise stated. It is intended as a general guide to the estimating engineer, and both the range of material and the market location will be extended as rapidly as possible. We give it with this caution, that, as is well understood in business transactions, the amount of bill, distance from market centre and conditions of payment will have a material influence on the final paying prices.

IRON.

STRUCTURAL IRON.			
Angles	1.9c.	@	2.2c.
Tee	2.2	@	2.25c.
Beams and channels	3.0c.	@	
Tank	1.9c.	@	2. 0c
Shell	2½c.	@	2¾c
Steel plates, Tank	2¾c.	@	3c.
WROUGHT-IRON PIPE., PITTSBURGH.			
Butt welded, black ..Discount	45	@	50
" " galvanized "	35	@	40
Lap welded black "	65c.	@	
" Galvanized "	45	@	50
Boiler tubes	60		
RAILS.			
Steel (large lots at mill)	$27.00	@	27.50
Old rails	16.50	@	17.00
Old rail steel	16.50	@	17.00
R. R. spikes	1.8	@	1.9c
R. R. splice-plates	1.65c.	@	1.75c.
R. R. Track Bolts	2.6c.	@	3c.
Barb-wire fencing, galvanized	4¾c.	@	5¼c.
" painted	3¾c.	@	4¼c.
Corrugated iron			
Nails			
Iron	2.25		
Steel	2.25		

METALS.

COPPER.			
Lake Superior	11.35	@	11.40
Other Brands	10¾	@	11¼
LEAD.			
Com. Domestic	3.65	@	3.70
Lead Pipe	.06¾		
Tin-Lined Lead Pipe	.15		
Sheet Lead	.06¾		
ZINC.			
Sheet	0.05	@	0.05¼

BRICK.

(Cargoes afloat)			
Haverstraw per M.	$6.25	@	6.50
Fishkill	4.75	@	5.50
Up-River	5.70	@	6.00
Jerseys	5.50	@	5.75
Long Island			
" pale			
FRONTS.			
Croton red	13.00	@	14.00
" dark	13.00	@	14.00
" brown	12.00	@	13.00
Philadelphia pressed	24.00	@	25.00
Trenton "	24.00	@	25.00
Baltimore "	37.00	@	41.00
Buff "	33.00	@	35.00
Enameled English	65.00	@	130.00
" American	85.00	@	120.00
Fire brick	25.00	@	40.00

CEMENT.

PORTLAND.			
Gibb's English 400 lbs. per bbl	2.75	@	2.90
K. B. & S. " "	2.85	@	3.00
Burham " "	2.70	@	2.85
Keene's fine " "	9.50	@	10.00
" course " "	5.00	@	6.00
Roman	2.75	@	3.50
Largerdorfer German "	2.55	@	2 80
Dyckerhoff, " "	2.90	@	3.25
Stettiner " "	2.60	@	2.65
Hanover " "	2.60	@	2.65
Vorwohler, Lion "	2.90	@	3.25
Alsen, " "	2.55	@	2.60
Fieve " "	2.40	@	2.50
Saylor's American	2.15	@	2.40
Windsor } U. S. C. Co.	1.00	@	1.1
Standard } U. S. C. Co.			1.15
Cable's Portland } U. S. C. Co.	2.15	@	2.40
ROSENDALE cements	1.00	@	1.10

LIME.

Rockland common per bbl	1.00		
" finishing	1.20		
State, common	.90		
" finishing	1.10		
Kingston, ground	0.95		
Add 25c. to above figures for yard rates.			

STONE.

Cargo rates at New York.

Amherst freestone, No. 1 per cub. ft.	0.90	@	95
" " No. 2 "	0.75	@	0.80
" " light drab "	0.80	@	0.95
Berlin " in rough "	0.75	@	1.00
Berea " " "	0.75	@	1.00
Brownstone, Portland, Ct. "	1.00	@	1.30
" Belleville, N. J. "	0.75	@	1.25
Granite, rough	0.60	@	1.25
Common building stone per load	2.00	@	3.00
Base stone, from 2½ to 6 ft. lengths, per lin. ft.	0.40	@	3.00

SLATE.

Purple roofing per square	6.00	@	7.00
Green "	6.00	@	7.00
Red "	15.00		
Black Penna. (at New York) "	4.50	@	5.00

LUMBER.

Prices for yard delivery in New York

PINE, Common box per M.	16.00	@	20.0
" Choice "	55.00	@	80.
" Tally plank, 1¼ in. 10 in. dres'd. each.	.44	@	.5
" Tally boards, dressed com. "	.28	@	.30
SPRUCE, Boards dressed "	.25	@	.28
" Plank, 1¼ in "	.28	@	.30
" " 2 in. "	.38	@	.40
" " 2 in. dressed "	.43	@	.45
Timber per M.	20.00	@	22.00
HEMLOCK, Boards each.	.18	@	.20
Joist, 2½ × 4 to 4 × in	.17	@	.44
OAK per M.	55.00	@	65.00
CYPRESS 1, 1¼, 2 and 2¼ in "	35.00	@	40.00
YELLOW PINE, Girders "	26.00	@	35.00
" Dressed flooring "	30.00	@	40.00
SHINGLES, Extra shaved pine, 16in. "			
" " sawed 18 in. "	5.75	@	6.00
LATH, Cargo rate "	2.40	@	2.50

PAINT.

Lead, white, American dry per lb	.04¾	@	.05
" " in oil pure "	.05¾	@	.05¾
English, B. B. in oil "	.08¾	@	.08¾
Red, American "	.05¾	@	.05¾
Litharge "	.05	@	.05¾
Venetian red, American "	.01	@	.01¾
Indian red "	.05	@	.10
Vermillion, American lead "	.11	@	.11¾
Paris green "	.15	@	.19
Umber, Amer. raw and powdered per lb.	.01¾	@	.01¾
Drop black, Amer. "	.08	@	.12
" " " "	.09	@	.11¾
Chrome green "	.05	@	.15
Oxide zinc, American "	.03¾	@	.04
" French "	.06¼	@	.06½

A New Method of Making Projectiles—Patents were issued at Washington, June 9th., for a new system for the production of spherical and conical projectiles. By the new process the old and tedious method of turning in a lathe to reduce to the proper shape, is avoided, the product coming perfectly formed. The Secretaries of War and the Navy thought so highly of its value that they asked to have the patent put through as quickly as possible. The inventor is G. F. Simmonds, of Fitchburg, Mass.